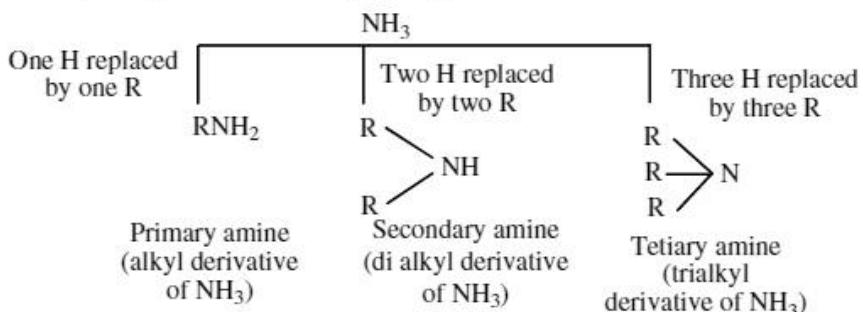


5. AMINES AND AZO COMPOUNDS

SYNOPSIS

AMINES

1. Amines are regarded as derivative of ammonia formed by the replacement of one or more hydrogen atoms by corresponding number of alkyl groups.



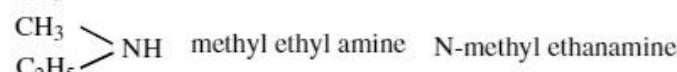
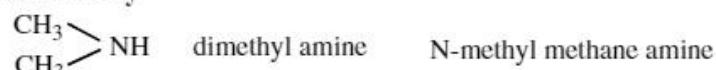
2. General formula of amines is $\text{C}_n\text{H}_{2n+3}\text{N}$ (may be P, S or T amine)

No.	Amines	General formula	Functional group
a	Primary or 1°	$\text{C}_n\text{H}_{2n+1}\text{NH}_2$	$-\text{NH}_2$ amino group
b	Secondary or 2°	$\text{C}_n\text{H}_{2n+2}\text{NH}$	$>\text{NH}$ imino group
c	Tertiary or 3°	$\text{C}_n\text{H}_{2n+3}\text{N}$	$\geqslant\text{NH}$ t.nitrogen group

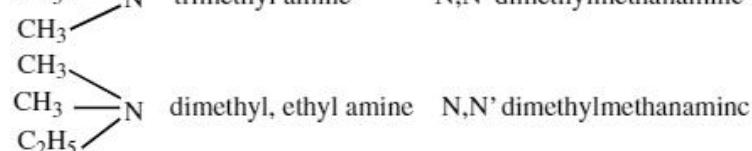
4. Nomenclature

Primary	Common Name	IUPAC Name
CH_2NH_2	Methyl amine	Methanamine or aminomethane
$\text{CH}_3\text{CH}_2\text{NH}_2$	Ethyl amine	Ethanamine
$\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$	Propyl amine	Propan-1-amine
$\begin{array}{c} \text{CH}_3\text{CHNH}_2 \\ \\ \text{CH}_3 \end{array}$	Iso Propyl amine	Propan-2-amine

Secondary

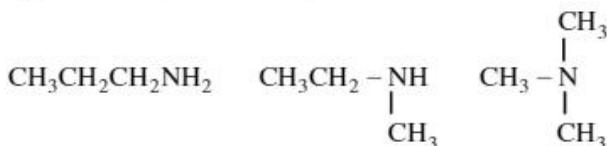


Tertiary:

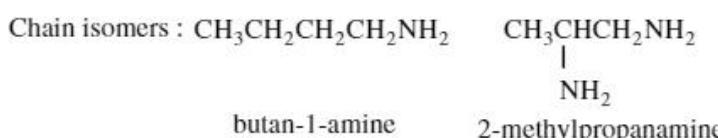
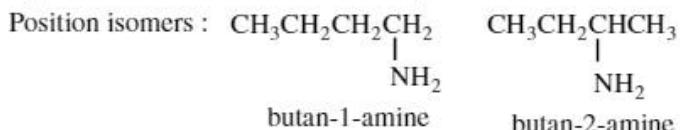


5. Isomerism:

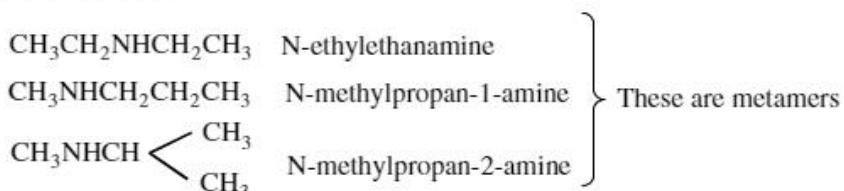
- a) Primary, secondary and tertiary amines are functional isomers



- b) Primary amines show chain as well as position isomerism within themselves



- c) Secondary amines show metamerism within themselves. >NH group is bivalent and thus always shows metamerism.

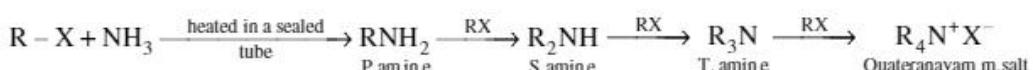


- d) Tertiary amines also show metamerism within themselves.

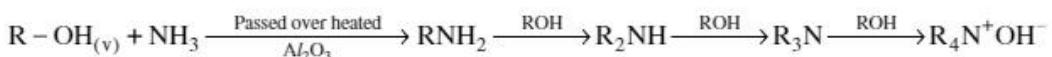
PREPARATION

1. By Hoffmann's method or Ammonolysis

- a) Ammonolysis of alkyl halide:

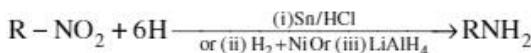


- b) Ammonolysis of alcohol:

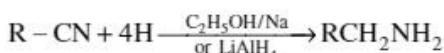


Both these methods give a mixture of primary, secondary, tertiary amines along with quaternary salt. However, these can be separated from each other by (1) fractional distillation or (2) Hofmann method or (3) Hinsberg method.

2. By reduction of nitro alkanes



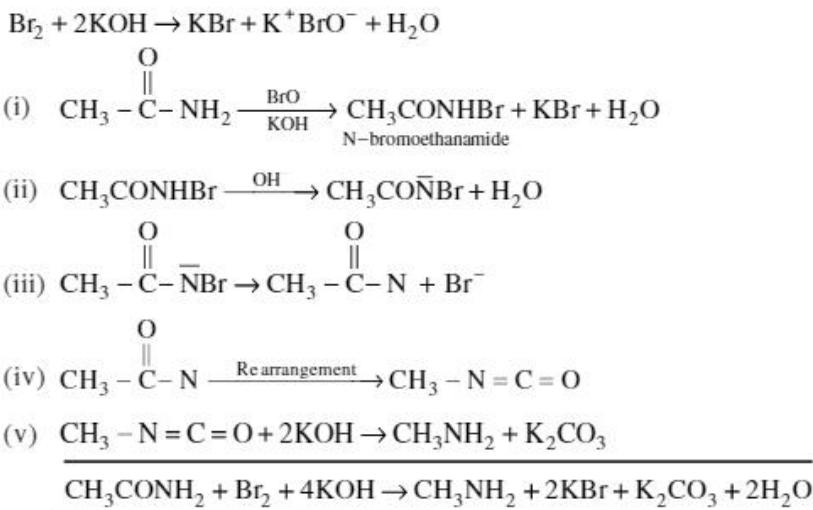
3. By the reduction of cyanides : (Mendius reaction)



Reduction of isocyanide gives secondary amines : $\text{R-NC} \xrightarrow{\text{C}_2\text{H}_5\text{OH+Na or LiAlH}_4} \text{RNHCH}_3$

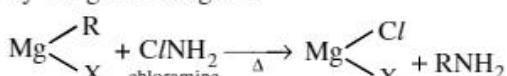
4. By the hydrolysis of isocyanide: $\text{R}-\text{N}\equiv\text{C} \xrightarrow[\text{H}^+(\text{HCl})]{\text{HOH}} \text{RNH}_2 + \text{HCOOH}$
5. By the hydrolysis of isocyanate: $\text{R}-\text{N}=\text{C}=\text{O} \xrightarrow{2\text{KOH}} \text{RNH}_2 + \text{K}_2\text{CO}_3$
6. By the reduction of acid amides: $\text{R}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2 \xrightarrow[\text{or (ii) C}_2\text{H}_5\text{OH}/\text{Na}]{\text{(i) LiAlH}_4} \text{RCH}_2\text{NH}_2$
7. By Hofamann's bromamide reaction
- A method to convert $-\text{CONH}_2$ gp to $-\text{NH}_2$ (decrease in carbon atom is noticed during amine formation).
 - The reaction is carried out by heating amides with Br_2 and KOH aq. Or with sodium hypobromite NaOBr .
- $$\text{RCONH}_2 + \text{Br}_2 + 4\text{KOH} \rightarrow \text{RNH}_2 + 2\text{KBr} + 2\text{H}_2\text{O} + \text{K}_2\text{CO}_3$$

(iii) The mechanism of the reaction is given below:

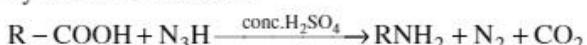


8. By reduction of aldoximes: $\text{R}-\text{CH}=\text{NOH} \xrightarrow[\text{or (ii) H}_2+\text{Ni}]{\text{(i) Na+alcohol or (iii) LiAlH}_4} \text{RCH}_2\text{NH}_2$

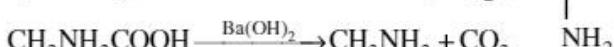
9. By Grignard reagent:



10. By Schmidt reaction:

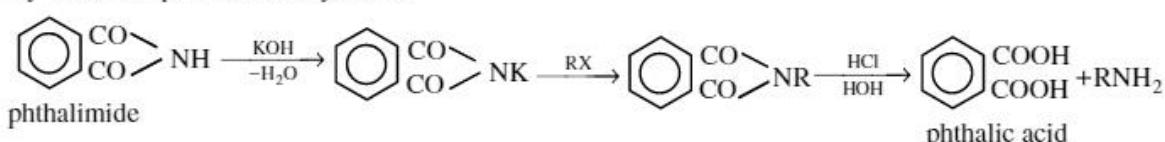


11. By heating α -amino acids with $\text{Ba}(\text{OH})_2$; $\text{RCHCOOH} \xrightarrow[\text{NH}_2]{\text{Ba}(\text{OH})_2, \Delta} \text{RCH}_2\text{NH}_2 + \text{CO}_2$



Glycine, the simplest amino acid

12. By Gabriesl phthalimide synthesis



PROPERTIES

- CH_3NH_2 is gas, middle one amines are colourless liquids with fishy smell ad higher amines are solid.
- Lower amines are soluble in water as they form H-bonding with water. Like others solubility decreases with increases in hydrophobic character of alkyl gps on N atom.
- Amines have weaker H-bonding than alcohols and acids and thus have lower boiling points than corresponding alcohol or acids.

1. Basic nature

- Amines are lewis base due to the presence of lone pair of electron on N atom available for co-ordination.
- The ease to donate lone pair of electron by an amine determines the relative basic nature of amines.
- The basic character of amines is more than NH_3 because of +I.E of alkyl groups which intensifies negative charge on N-atom and therefore increases the tendency to donate the electron pair. The basic nature is however also influenced by steric factors particularly in tertiary amines.

An examination of P_{kb} values of some methyl amines and ethyl amines reveals the relative basic character as:

P_{kb}	NH_3	CH_3NH_2	$(\text{CH}_3)_2\text{NH}$	$(\text{CH}_3)_3\text{N}$
	4.73	3.32	3.23	4.2
P_{kb}	NH_3	$\text{C}_2\text{H}_5\text{NH}_2$	$(\text{C}_2\text{H}_5)_2\text{NH}$	$(\text{C}_2\text{H}_5)_3\text{N}$
	4.73	3.37	3.07	3.13

Methyl amines : $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N} > \text{NH}_3$

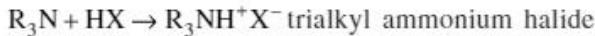
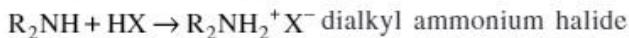
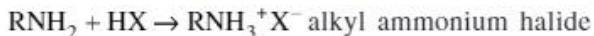
Ethyl amines : $(\text{C}_2\text{H}_5)_2\text{NH} > (\text{C}_2\text{H}_5)_3\text{N} > \text{C}_2\text{H}_5\text{NH}_2 > \text{NH}_3$

The alkyl groups, which are electron releasing groups, intensify the electron density around the nitrogen atom and thereby increasing the availability of the lone pair of electrons to proton or Lewis acids. Thus, it is expected that the basic nature of amines should be in the order tertiary > secondary > primary, but the observed order in the case of lower members is found to be as:

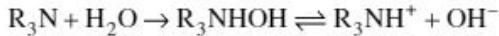
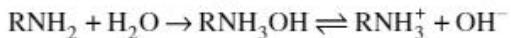
Secondary > primary > tertiary. This anomalous behaviour of tertiary amines is due to steric factors i.e., crowding of alkyl groups makes the approach and bonding by a proton relatively difficult. The electrons are there but the path is blocked. Furthermore, all lower amines except amines containing tertiary butyl groups are stronger base than ammonia.

The basic character of amines is also influenced by hydration which give rise to stabilization of protonated amine with water. However, in vapour phase where hydration effect is not present, the basic nature follows the order: $\text{Et}_3\text{N} > \text{Et}_2\text{NH} > \text{EtNH}_2$

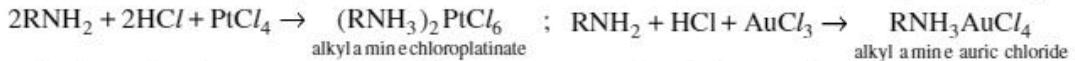
- Amines react with acid to form salt, soluble in water producing quaternary ammonium salts.



- Soluble amines form hydroxides in water to give OH^- ions

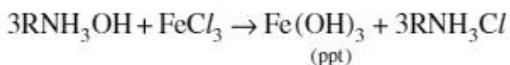


- f) Double salt formation: The hydrochlorides of amines form double salt with PtCl_4 and AuCl_3



These double salts decompose on ignition to pure metal and thus method is used to determine molecular weight of amines.

- g) Aqueous solution of amines behaves like NH_4OH and precipitates out iron, chromium and aluminium as hydroxides from their salts.



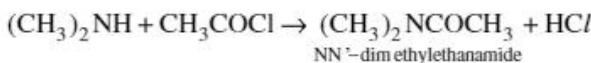
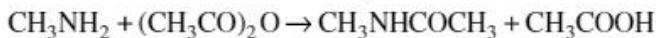
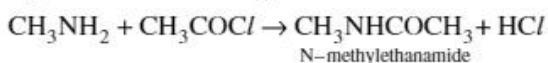
2. Alkylation:

- a) Amine reacts with alkyl halides to form secondary, tertiary and quaternary ammonium halide to show S_N reactions.
- b) Primary amines take three molecules, secondary amines take two molecules and tertiary amines take one molecule of alkyl halide to show complete alkylation. Therefore, the reaction is used to distinguish P,S & T amines.

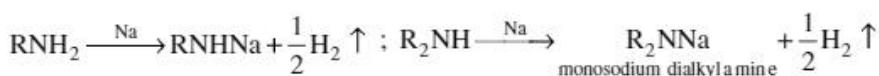


3. Acylation:

- a) Reaction with RCOCl or (CH_3COCl) or $(\text{RCO})_2\text{O}$ or $[(\text{CH}_3\text{CO})_2\text{O}]$ is known as acylation or acetylation respectively. This is nucleophilic substitution (S_N) reaction.
- b) Tertiary amines are not acylated. A distinction test for tertiary amines.



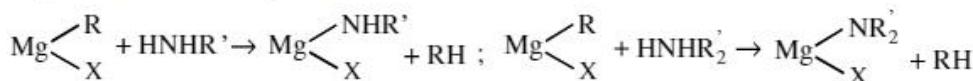
4. Action of Na : Primary and secondary amines on heating with sodium gives effervesces of H_2 . Tertiary amines do not react.



5. Action of Cl_2 : Primary and secondary amines show substitution of H atom on N atom by halogens on heating in presence of alkali. Tertiary amines are not halogenated.



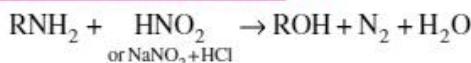
6. Action of Grignard reagent : Active H on N atom in P & S amines is used by alkyl gp of RMgX to give alkane. Tertiary amines do not react.



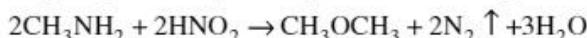
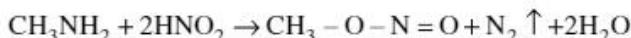
7. Action of HNO_2 :

- a) P, S and T amines behave differently towards nitrous acid.
b) It is a distinction test for P, S and T amines.

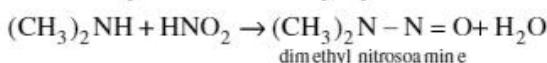
Primary amines: Alcohols are produced with liberation of N_2 .



CH_3NH_2 is an exception to this reaction. It however shows the following reactions.

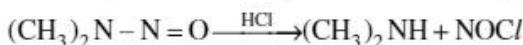


Secondary amines: Produce reddish yellow oily compounds called nitrosoamines. These are steam volatile and separated out easily by distillation.



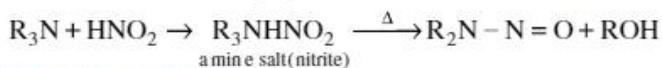
These on warming with a crystal of phenol with few drops of conc. H_2SO_4 produces a green solution which turns blue on addition of NaOH. This reaction is known as Libermann's nitroso reaction and is used to test secondary amines.

Also these nitroso amines on heating with HCl regenerate secondary amine and thus method is used to separate secondary amine from the primary, secondary and tertiary amine mixtures.

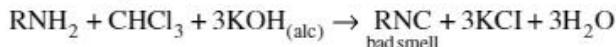


Tertiary amines: Dissolves in cold HNO_2 and form unstable nitrite salt with no visible sign of reaction like primary amines (evolution of N_2) and secondary amines (yellow colour formation).

These salts on heating give nitrosoamine and alcohol.

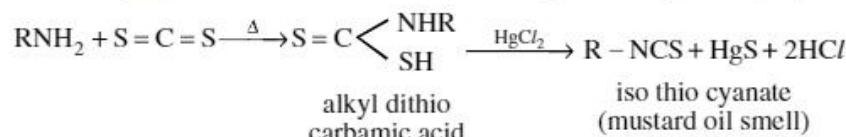


8. **Carbylamine reaction:** A distinction test for primary amines: All primary amines (aliphatic or aromatic) on heating with alcoholic KOH and CHCl_3 give unpleasant or foul smell of isocyanide which is easily detected.

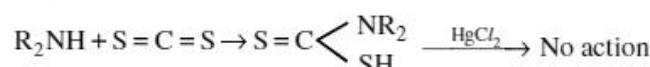


Note: 2,4-d-methyl aniline does not show this reaction due to steric hindrance.

9. **Hofmann's mustard oil reaction:** P, S, T amines behave differently towards this reaction. Primary amines: Give pungent mustard oil smell on heating with CS_2 and HgCl_2

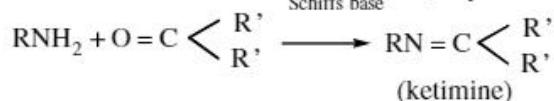
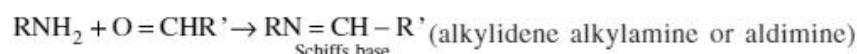


Secondary amines: Form salts of dialkyl dithiocarbamic acid with CS_2 which are not decomposed by HgCl_2



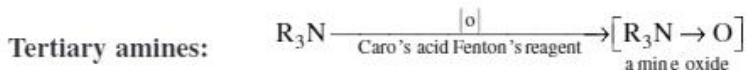
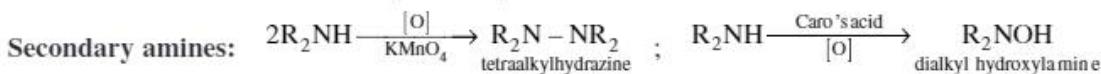
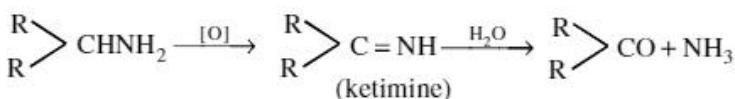
Tertiary amines: Do not react with CS_2

10. **Action of aldehydes:** Only primary amines react with aldehydes and give a class of compounds known as Schiff's base.



11. Oxidation:

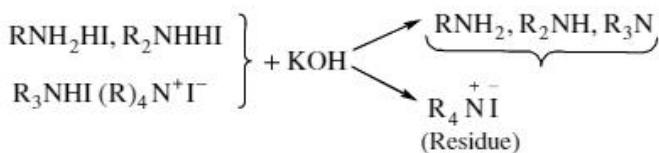
- a) Amines are oxidized producing different products depending upon the nature of oxidant, class of amine and nature of alkyl group present. Primary amines: Produce aldimine or ketimine by acidified KMnO_4



Uses: In solvent extraction process, in petroleum refining and as a stabilizer for rubber latex.

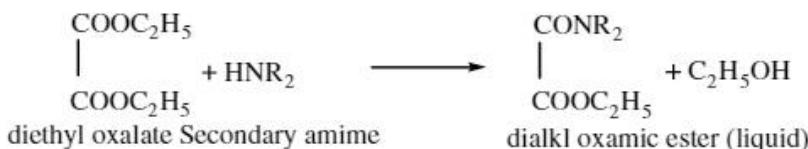
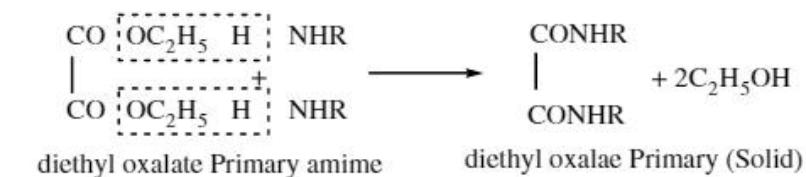
SEPARATION OF MIXTURE OF AMINES:

A mixture of primary, secondary and tertiary amines along with quaternary ammonium salt is separated as follows, First of all mixture is distilled with KOH solution when a mixture of amines distills over leaving behind the non volatile quaternary ammonium salt.



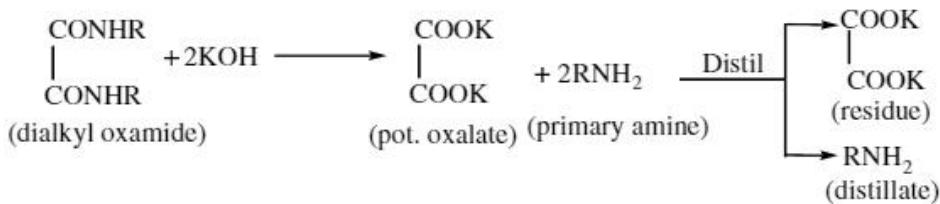
The mixture of the three amines in the distillate is then separated by either of the following methods.

- Fractional distillation:** The mixture of three amines is subjected to fractional distillation when different amines distill over at different temperatures because of their different boiling points.
- Hofmann method:** The mixture of three amines is heated with diethyl oxalate (Hoffmann reagent). Primary amine forms solid oxamide, secondary amine forms a liquid oxamic ester, and the tertiary amine does not react at all.

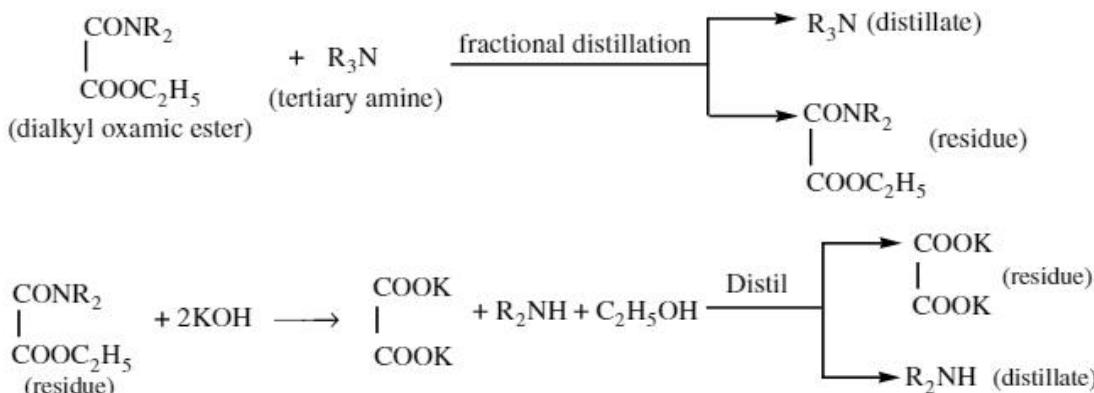


The mixture obtained is filtered when oxamide comes on the filter paper and oxamic ester and tertiary amine go to filtrate.

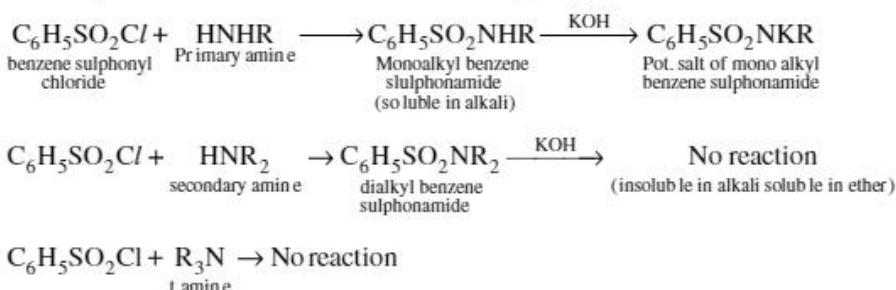
Recovery of primary amine: The solid oxamide is hydrolysed with boiling alkali to regenerate the primary amine which is collected as distillate on distilling the reaction mixture.



Recovery of secondary and tertiary amines : The filterate containing oxamic ester and tertiary amine is fractionally distilled when the free tertiary amine distills over. The residue having oxamic ester is hydrolysed with boiling alkali to liberate free secondary amine which is collected ad distillate by distilling the reaction mixture.



3. **Hinsberg method:** The mixture of amines is treated with benzene sulphonyl chloride (Hinsberg's reagent) and shaken with alkali solution.
- Primary amines form alkyl benzene sulphonamides which dissolve in alkali to form sodium or potassium salt of monoalkyl benzene sulphonamides.
 - Secondary amines form dialkyl benzene sulphonamides which do not form salt with alkali and remains insoluble in alkali solution.
 - Tertiary amines do not react with Hinsberg reagent.



CHEMICAL

- Hydrolysis:** Alkyl isocyanides are hydrolysed by dilute mineral acids (but not by alkalies) to from primary amines:
- Reduction:** $\text{RN} \rightleftharpoons \text{C} + 2\text{H}_2\text{O} \xrightarrow{\text{H}^+} \text{RNH}_2 + \text{HCOOH}$
- Action of Heat:** $\text{RN} \rightleftharpoons \text{C} + 4\text{H} \longrightarrow \text{RNHCH}_3$; $\text{RNC} \xrightarrow[250^\circ\text{C}]{\text{heat}} \text{RCN}$

- iv) **Addition reaction:** Alkyl isocyanides give addition reactions due to presence of unshared electron pair on carbon atom. $R:N\cdots C$ or $R-N\equiv C$

The following are some of the addition reactions shown by alkyl isocyanides.



LECTURE SHEET

EXERCISE-I

(Classification, Nomenclature isomerism)

LEVEL-I (MAIN)

Straight Objective Type Questions

1. IUPAC name of $(CH_3)_3C.NH_2$ is
 - 1) trimethyl amine
 - 2) 2-methyl butanamine-1
 - 3) 2-methyl propanamine-2
 - 4) 2-methyl propanamine-1
2. Which of the following is not a tertiary amine ?
 - 1) tri ethyl amine
 - 2) tri methyl amine
 - 3) 2-methyl propanamine-2
 - 4) N-ethyl-N-methyl propanamine-1
3. Which of the following shows optical activity?
 - 1) butanamine-1
 - 2) butanamine-2
 - 3) isopropyl amine
 - 4) ethyl methyl amine
4. IUPAC name of $(C_2H_5)_3C-NH_2$ is
 - 1) 3-ethyl propanamine-1
 - 2) 3-ethyl pentanamine-2
 - 3) 3-ethyl pentanamine-3
 - 4) 2-ethyl pentanamine-3
5. Which of the following is a 1° amine
 - 1) Tert. butylamine
 - 2) dimethyl amine
 - 3) N - methylaniline
 - 4) N, N-dimethyl aniline
6. Which of the following is a mixed 2° amine
 - 1) Toluidine
 - 2) N - Methylaniline
 - 3) Dimethylamine
 - 4) Methyl diethyl amine
7. The general formula of amines is
 - 1) $C_nH_{2n+1}N$
 - 2) $C_nH_{2n+2}N$
 - 3) $C_nH_{2n+3}N$
 - 4) $C_nH_{2n}N$
8. The general formula of quaternary ammonium salt is
 - 1) RNH_2
 - 2) R_2NH
 - 3) R_3N
 - 4) $R_4N^+X^-$

Numerical Value Type Questions

9. How many primary amine structural isomers with the molecular formula $C_4H_{11}N$.

LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. Which of the following contains imino group [>NH]
 - a) Aniline
 - b) O - Toluidine
 - c) Benzylamine
 - d) N-methyl aniline

2. Benadryl, an antihistaminic drug contains
a) A primary amine group b) Secondary amine group
c) Tertiary amine group d) All the above
3. The correct IUPAC name of $\text{C}_2\text{H}_5 - \text{N} - \text{CH}_2\text{CH}_2\text{CH}_3$ is
$$\begin{array}{c} | \\ \text{CH}_3 \end{array}$$

a) N, N – diethyl butylamine
b) N – Ethyl – N – methyl butylamine
c) N – Ethyl – N – methyl butanamine
d) N – Ethyl – N – methyl Propan – 1 – amine

Integer Type Questions

4. The number of resonating structures of arylammonium ion is
5. The number of resonating structures of aniline is 5
6. Among $\text{CH}_3\text{CH}_2\text{NH}_2$, CH_3CN , HCONH_2 and CH_3CONH_2 , the number of compounds which acts as both electrophile and nucleophile are

EXERCISE-II
(*Basic nature*)
LEVEL-I (MAIN)

Straight Objective Type Questions

1. In-correct statement among the following is
1) methanamine is more basic than ammonia 2) ammonia forms H-bonds
3) boiling point of ethyl amine is higher than propane 4) dimethyl amine is less basic than aniline
2. (A) : N-methyl ethanamine is more basic than N,N-dimethyl ethanamine
(R) : +I effect is more in former than the later
1) A and R are true and R explains A 2) A and R are true but R does not explain A
3) A is true but R is false 4) A is false but R is true
3. Molecular association is highest in
1) n-propyl amine 2) trimethyl amine 3) ethyl methyl amine 4) equal in all
4. Aniline is less basic than
1) NH_3 2) CH_3NH_2
3) N - methyl Aniline 4) All the above
5. Among the following which is more basic
1) n - butyl amine 2) isobutylamine 3) Sec. butylamine 4) diethylamine
6. Towards litmus, Aniline is
1) Acidic 2) Basic 3) Neutral 4) Bleaching agent
7. The amine that does not form hydrogen bonds is
1) Isopropyl amine 2) Neopentyl amine
3) Tertiary butyl amine 4) N, N – Dimethyl amino ethane

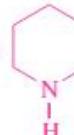
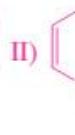
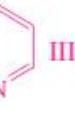
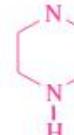
LEVEL-II (ADVANCED)

Straight Objective Type Questions

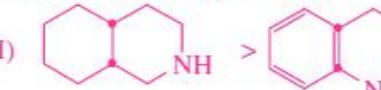
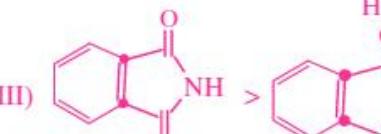
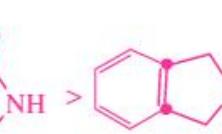
1. Among isomeric amines possible for molecular formula C_3H_9N , correct order of basic strength is given by
 I) propanamine-1 II) N-methyl ethanamine
 III) N,N-dimethyl methanamine
 a) III > I > II b) III > II > I c) II > III > I d) II = II > III
2. Which of the following is correct with respect to the order of basic natures of different amines given below ?
 b) $C_6H_5NH_2 > NH_3 > CH_3NH_2 > (CH_3)_2NH$ b) $(CH_3)_2NH > CH_3NH_2 > C_6H_5NH_2 > NH_3$
 c) $CH_3NH_2 > (CH_3)_2NH > C_6H_5NH_2 > NH_3$ d) $(CH_3)_2NH > CH_3NH_2 > NH_3 > C_6H_5NH_2$
3. Examine the following two structures for the aniliniumion and chose the correct statement from among the following.

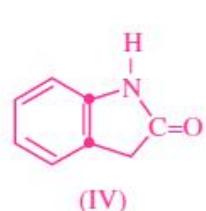
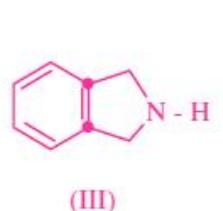
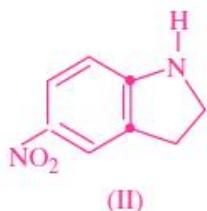
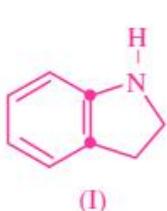


- a) II is not acceptable canonical structure because carbonium ions less stable than ammonium ions
 b) II is not an acceptable canonical structure because it is nonaromatic
 c) II is not an acceptable canonical structure because nitrogen has 10 valence electrons
 d) II is an acceptable canonical structure
4. Which of the following order is correct regarding the relative basicity of amines?
 a) $CH_3O-C_6H_4-NH_2 > C_6H_4-NH_2 > O_2N-C_6H_4-NH_2$
 b) $CH_3O-C_6H_4-NH_2 < C_6H_4-NH_2 < O_2N-C_6H_4-NH_2$
 c) $CH_3O-C_6H_4-NH_2 < O_2N-C_6H_4-NH_2 < C_6H_4-NH_2$
 d) $O_2N-C_6H_4-NH_2 < CH_3O-C_6H_4-NH_2 < C_6H_4-NH_2$
5. Activation of benzene ring by $-NH_2$ in aniline can be decreased by treating with
 a) Dilute HCl b) Ethyl alcohol c) Acetic acid d) Acetyl chloride
6. Which of the following orders is correct regarding the basic strength of substituted aniline
 a) P-nitroaniline > P-aminobenzaldehyde > P-bromoaniline
 b) P-nitroaniline < P-bromoaniline < P-aminobenzaldehyde
 c) P-nitroaniline < P-aminobenzaldehyde < P-bromoaniline
 d) P-nitroaniline > P-aminobenzaldehyde < P-bromoaniline

7. Which of the following orders regarding the basic strength of substituted aniline is correct
 a) P-methylaniline > P-chloroaniline > P-aminoacetophenone
 b) P-methylaniline > P-aminoacetophenone > P-chloroaniline
 c) P-aminoacetophenone > P-methylaniline > P-chloroaniline
 d) P-aminoacetophenone > P-chloroaniline > P-methylaniline
8. In the following compounds I)  II)  III)  IV)  the order of basicity is
 a) IV > I > III > II b) III > I > IV > II c) II > I < III > IV d) I > III > II > IV
9. Among the following, the strongest base is
 a) $C_6H_5NH_2$ b) $P-NO_2C_6H_4NH_2$ c) $m-NO_2C_6H_4NH_2$ d) $C_6H_5CH_2NH_2$

More than One correct answer Type Questions

10. Consider following comparison of basic nature of amines
- I)  > 
- II)  >  > 
- III)  >  > 
- Correct comparisons are
 a) I b) (II) c) (I) and (II) d) (I) and (III)
11. For the given compounds .



The correct statement is

- a) The most basic compound is (III) b) The most basic compound is (I)
 c) The increasing order of basicity is (IV) < (II) < (I) < (III)
 d) The increasing order of basicity is (II) < (IV) < (I) < (III)
12. Which of the following is the strongest base in aqueous solution
 a) $(CH_3)_3N$ b) $(CH_3)_2NCH_2CH_2OH$ c) $CH_3CH_2CH_2NHOH$ d) $(CH_3)_4NOH$
13. Which of the following statements is/are correct?
 a) Aliphatic amines are stronger bases than ammonia.
 b) Aromatic amines are stronger bases than ammonia
 c) Alkyl group in aliphatic amines donate electrons to nitrogen
 d) The electrons on nitrogen are delocalised in benzene ring

14. Which of the following statements is/are correct?

- Primary amines show intermolecular hydrogen bonding
- Secondary amines shows intermolecular hydrogen bonding.
- Tertiary amines show intermolecular hydrogen bonding.
- Amines have lower boiling points as compared to those of alcohols and carboxylic acids of comparable.

15. Benzylamine is more basic than

- | | |
|-------------------|---------------------|
| a) Aniline | b) Ammonia |
| c) p-nitroaniline | d) Sodium hydroxide |

Matrix Matching Type Questions

16. **Column-I**

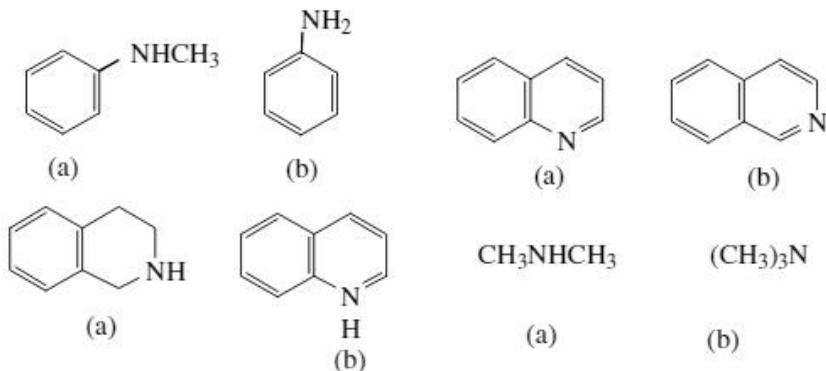
- A) $\text{CH}_3\text{CH}_2\text{CH}_2\ddot{\text{N}}\text{H}_2$
- B) $\text{CH}_3\text{CH}_2\ddot{\text{N}}\text{HCH}_3$
- C) $(\text{CH}_3)_3\ddot{\text{N}}$
- D) $(\text{CH}_3)_4\overset{+}{\text{N}}\overset{-}{\text{O}}\text{H}$

Column-II

- p) Inter molecular H- bonding exists
- q) Enters into H - bonding with water when dissolved in water
- r) Reacts with dil. HCl to form a water soluble salt
- s) Highest basic compound when dissolved in water

IntegerType Questions

17. From among following pairs, number of pairs in which first compound is more basic than second compound is



◆ EXERCISE-III ◆

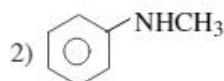
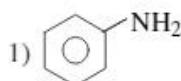
(Preparation of Amines)

LEVEL-I (MAIN)

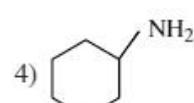
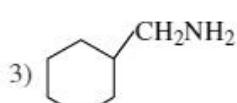
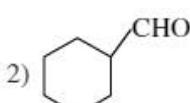
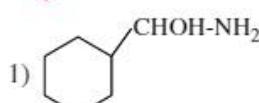
Straight Objective Type Questions

- Nitrobenzene on reduction with Hydrogen in presence of Nickel gives
 - Azobenzene
 - Hydrazobenzene
 - Phenyl hydroxyl amine
 - Aniline
- Acetamide is treated separately with the following reagents. Which one of these would give methylamine?
 - PCl_5
 - Sodalime
 - $\text{NaOH}+\text{Br}_2$
 - hot conc. H_2SO_4
- Which of the following amine cannot be prepared by Gabriel phthalimide synthesis?
 - $\text{CH}_3\text{CH}_2-\text{NH}_2$
 - $(\text{CH}_3)_2\text{CH}-\text{NH}_2$
 - $\text{Ph}-\text{NH}_2$
 - $\text{C}_2\text{H}_5-\text{NH}_2$

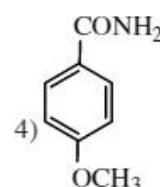
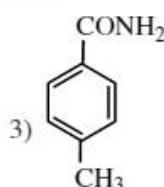
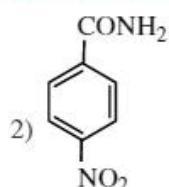
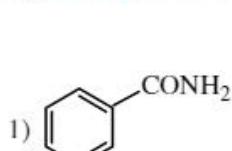
4. Gabriel-Phthalimide reaction is useful for preparation of



5.
 $\xrightarrow{\text{LiAlH}_4}$. The product of the reaction is

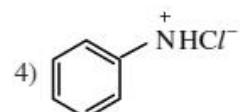
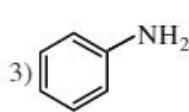
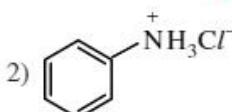
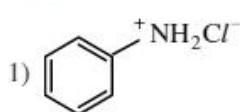


6. Hofmann bromamide reaction involves the conversion of amides into amines. Which of the following undergo at fastest rate under identical conditions



7.
 $\xrightarrow{\text{Sn-HCl}}$ A $\xrightarrow{\text{NaOH}}$

A in the above sequence is



8. Which statement about the reaction of 1-bromobutane and NH₃ is incorrect?

- 1) The reaction initially gives a primary amine
- 2) The reaction specifically gives a primary amine
- 3) The reaction is a nucleophilic substitution
- 4) The reaction may lead to the formation of a quaternary ammonium salt.

9. Which of the following reagents would be best for converting phenylacetamide (C₆H₅CH₂CONH₂) to phenethylamine (C₆H₅CH₂CH₂NH₂)?

- 1) H₂ & Pt catalyst
- 2) NaBH₃CN
- 3) LiAlH₄ in ether
- 4) Aqueous NaOBr.

10. Which compound on reduction with LiAlH₄ give n-butylamine

- 1) n-Butylcyanide
- 2) n-Propylcyanide
- 3) Propyl methyl amine
- 4) Ethyl cyanide

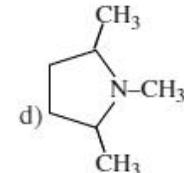
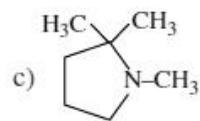
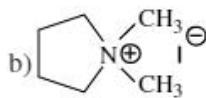
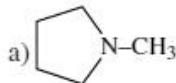
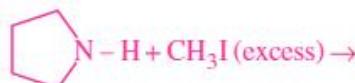
LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. Which of the following methods is used to prepare Aniline on large scale ?

- A) C₆H₅NO₂ + 6(H) $\xrightarrow{\text{Fe/HCl}}$ C₆H₅NH₂ + 2H₂O
 - B) C₆H₅NO₂ + 6(H) $\xrightarrow{\text{Sn/HCl}}$ C₆H₅NH₂ + 2H₂O
 - C) C₆H₅OH₂ + NH₃ $\xrightarrow[300^\circ\text{C}]{\text{ZnCl}_2}$ C₆H₅NH₂ + H₂O
 - D) C₆H₅Cl + 2NH₃ $\xrightarrow{\text{Cu}_2 200^\circ\text{C}}$ C₆H₅NH₂ + NH₄Cl
- a) A only b) B or C c) C only d) A or D

2. Reaction of RCONH_2 with a mixture of Br_2 and KOH gives RNH_2 as the main product. The intermediates involved in the reaction are
- a) $\text{R}-\text{N}\text{C}$ b) $\text{R}-\text{NHBr}$ c) $\text{R}-\text{N}=\text{C}=\text{O}$ d) $\text{R}-\overset{\text{O}}{\underset{\text{Br}}{\text{C}}} - \text{N} \begin{cases} \text{Br} \\ \text{Br} \end{cases}$
3. Which sequence of reactions is best suitable method for preparation of m-chloroaniline from benzene
- a) (i) nitration (ii) $\text{Cl}_2/\text{FeCl}_3$ (iii) $\text{Sn} + \text{HCl}$ b) (ii) $\text{Cl}_2/\text{FeCl}_3$ (ii) nitration (iii) $\text{Sn} + \text{HCl}$
 c) (ii) $\text{Cl}_2/\text{FeCl}_3$ (ii) NH_3 & ZnCl_2 d) (ii) Nitration (ii) Cl_2 , acetic acid, (iii) $\text{Sn} + \text{HCl}$
4. Which sequence of reactions is useful to prepare 1 – propanamine
- a) $\text{CH}_3\text{CH}_2\text{CN} \xrightarrow{\text{LiAlH}_4}$ b) $\text{CH}_3\text{CH}_2\text{Cl} \xrightarrow{\text{AgCN}} \xrightarrow{\text{LiAlH}_4}$
 c) $\text{CH}_3\text{Cl} \xrightarrow{\text{KCN}} \xrightarrow{\text{LiAlH}_4}$ d) $\text{CH}_3\text{Cl} \xrightarrow{\text{AgCN}} \xrightarrow{\text{LiAlH}_4}$
5. Which of the following reaction give primary amine
- a) $\text{CH}_3\text{CH}_2\text{CONH}_2 \xrightarrow{\text{LiAlH}_4}$ b) $\text{CH}_3\text{CH}_2\text{NC} \xrightarrow{\text{Na&C}_2\text{H}_5\text{OH}}$
 c) $\text{CH}_3\text{CONHCH}_3 \xrightarrow{\text{LiAlH}_4}$ d) $\text{CH}_3\text{CH}_2\text{CN} \xrightarrow{\text{H}_3\text{O}^+}$
6. Which of the following species is not formed in Hofmann bromamide reaction
- a) $\text{R}-\text{CO NHBr}$ b) $\text{RCO}\ddot{\text{N}}\text{Br}$ c) RNCO d) $\text{RCO}\ddot{\text{N}}\Theta$
7. N, N – dimethyl benzamide cannot be prepared by
- a) $\text{C}_6\text{H}_5\text{COOC}_2\text{H}_5 + (\text{CH}_3)_2\text{NH} \longrightarrow$ b) $\text{C}_6\text{H}_5\text{COCl} + (\text{CH}_3)_2\text{NH} \longrightarrow$
 c) $\text{C}_6\text{H}_5\text{COOC}_2\text{H}_5 + (\text{CH}_3)_2\text{NH} \longrightarrow$ d) $\text{C}_6\text{H}_5\text{CO NH}_2 + \text{CH}_3\text{MgCl} \longrightarrow$
8. Which compound is the likely product from reaction of pyrrolidine with excess methyl iodide (equation below)?



9. Which of the following reagents and conditions would be best for the preparation of cyclohexylamine?
- a) Cyclohexanone + NH_3 + NaBH_3CN . b) Cyclohexylbromide + 2 NH_3 .
 c) Cyclohexylbromide + NaNH_2 . d) Cyclohexene + NH_3 .
10. Which of the following procedures would be best for preparing dimethylcyclohexylamine, $\text{C}_6\text{H}_{11}\text{N}(\text{CH}_3)_2$?
- a) (i) Dimethylamine + Cyclohexanone (ii) NaBH_3CN in methanol
 b) Dimethylamine + Cyclohexylbromide in ether
 c) Cyclohexylamine + 2 CH_3I in ether
 d) (i) Cyclohexylbromide + NaCN in methanol (ii) 2 CH_3Li in THF

11. Which of the following sequence of reactions is useful to prepare following compound from benzene?

- CH_3Cl , AlCl_3 ; HNO_3 , H_2SO_4 ; H_2
- CH_3Cl , AlCl_3 ; HNO_3 , H_2SO_4 ; Fe , HCl ; NaOH
- HNO_3 , H_2SO_4 ; Fe , HCl ; NaOH ; CH_3Cl , AlCl_3
- HNO_3 , H_2SO_4 ; CH_3Cl , AlCl_3 ; Fe , HCl ; NaOH



EXERCISE-IV

(Properties of Amine)

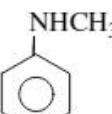
LEVEL-I (MAIN)

Straight Objective Type Questions

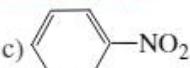
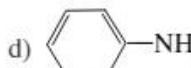
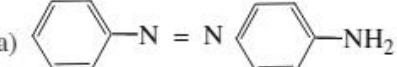
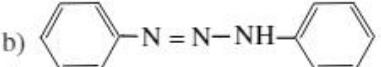
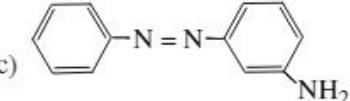
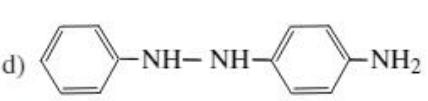
- Chemical formula of Hinsberg's reagent is
 - $\text{C}_6\text{H}_5\text{SO}_3\text{H}$
 - $\text{C}_6\text{H}_5\text{NHSO}_2\text{C}_6\text{H}_5$
 - $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$
 - $\text{C}_6\text{H}_5\text{NHCOC}_6\text{H}_5$
- For carbyl amine reaction, we need alcoholic KOH and
 - any primary amine and chloroform
 - aromatic primary amine and chloroform
 - aliphatic primary amine and chloroform
 - any amine and chloroform
- Aniline on acetylation gives
 - phenol
 - acetamide
 - acetanilide
 - benzene
- Treatment of ammonia on excess of alkyl halide yields
 - triethyl amine
 - quaternary ammonium salt
 - diethyl amine
 - ethyl amine
- Aniline on reaction with con. H_2SO_4 gives X. If X is heated, the product is
 - sulphanilic acid
 - sulphonamide
 - benzene sulphonyl chloride
 - m-amino benzene sulphonic acid
- A primary amine on reaction with alc.KOH and chloroform yields
 - isocyanide
 - aldehyde
 - cyanide
 - alcohol
- Primary amines have lower boiling points than
 - corresponding alkanes
 - corresponding 2° and 3° amines
 - corresponding esters
 - corresponding alcohols
- Which functional group responds to carbylamine test?
 - $-\text{NH}_2$
 - NH
 - $-\text{CONH}_2$
 - N
- Impure Aniline is purified by
 - distillation
 - steam distillation
 - distillation under reduced pressure
 - fractional crystallisation
- Which of the following can react with an alkyl halide
 - 1° amine
 - 2° amine
 - 3° amine
 - All the above
- Aniline doesn't react with
 - dil. HCl
 - dil. NaOH
 - CH_3CHO
 - Br_2 water
- Aniline is soluble in
 - dil. HCl
 - dil. NaOH
 - Water
 - Na_2CO_3 solution

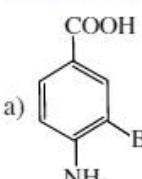
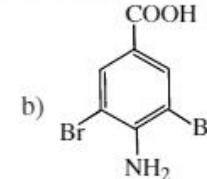
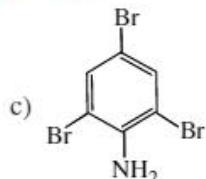
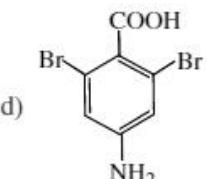
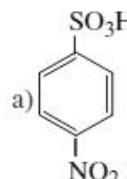
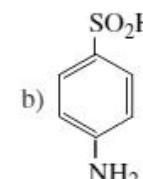
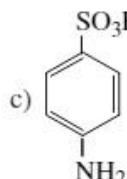
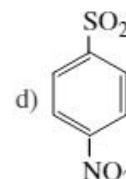
13. Aniline is treated with excess of CH_3I . The final product is
 1) $\text{C}_6\text{H}_5\text{NHCH}_3$ 2) $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$ 3) $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_3\text{I}$ 4) $\text{C}_6\text{H}_5\text{I}$
14. The reagent which gets attached to the nucleus when added to aniline
 1) CH_3I 2) $\text{C}_6\text{H}_5\text{COCl}$ 3) CH_3COCl 4) Br_2
15. Which of the following is not a property of aniline
 1) It is basic in nature 2) It gives carbylamine test
 3) It can react with 3 moles of alkylhalide 4) It turns blue litmus red
16. Freshly prepared aniline is?
 1) Colourless 2) Brown 3) Yellow 4) Pale Yellow
17. Aniline forms anilinium salt when it reacts with
 1) An alkyl halide 2) Acetyl chloride 3) Sulphuric acid 4) Benzoyl chloride
18. In the diazotisation of Aniline, the reagent or reagents used
 1) HNO_3 , HCl 2) NaNO_2 , HCl at $0\text{--}5^\circ\text{C}$
 3) NaNO_2 , HNO_2 at $0\text{--}5^\circ\text{C}$ 4) HNO_2 only

Numerical Value Type Questions

19.  can react with a maximum of moles of CH_3I

LEVEL-II (ADVANCED)**Straight Objective Type Questions**

1. Bromination of Aniline with bromine water mainly gives
 a) Red precipitate of 2, 4, 6 – tribromo aniline b) Ortho and Para bromo anilines
 c) 2, 4 – Dibromo aniline d) White precipitate of 2, 4, 6 – Tribromo aniline
2. In the nitration of aniline the amino group is protected by conversion into
 a) Tribromo derivative b) Isocyanide c) Diazonium salt d) Acetyl derivative
3. Which of the following give(s) Libermann's nitroso reaction ?
 a)  b) $\text{C}_6\text{H}_5-\text{NH}-\text{CH}_3$ c)  d) 
4. p-Chloroaniline and anilinium hydrochloride can distinguished by
 a) AgNO_3 b) NaHCO_3 c) Solubility d) Carbylamine reaction
5. When aniline is treated with benzene diazonium chloride at low temperature in weakly acidic medium the final product is
 a)  b) 
 c)  d) 
6. Which compound/s do not undergo diazolisation?
 a) $\text{C}_6\text{H}_5\text{NH}_2$ b) $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$ c) $\text{H}_6\text{C}_5\begin{cases} \text{NH}_2 \\ \text{CH}_3 \end{cases}$ d) $\text{H}_4\text{C}_6\begin{cases} \text{NH}_2 \\ \text{NO}_2 \end{cases}$

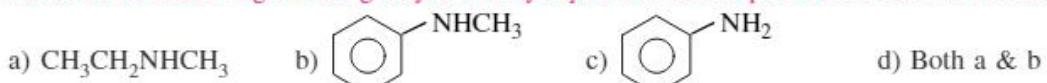
7. Which of the following species is not formed in Hofmann bromamide reaction
 a) $\text{R}-\text{CO-NHBr}$ b) $\text{RCO}\ddot{\text{N}}\text{Br}$ c) RNCO d) $\text{RCO}\ddot{\text{N}}\Theta$
8. p-aminobenzoic acid reacts with bromine and H_2O to give
- a)  b)  c)  d) 
9. A nitrogen containing compound dissolves in 10% aq. sulphuric acid.
 The Hinsberg test ($\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ in base) gives a solid product that is not soluble in 10% aq. NaOH.
 Which of the following would best fit these facts?
 a) N,N-Dimethylaniline, $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$ b) N-Methylbenzamide, $\text{C}_6\text{H}_5\text{CONHCH}_3$
 c) N-Methylaniline, $\text{C}_6\text{H}_5\text{NHCH}_3$ d) Benzylamine, $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$
10. The formula of sulphanilic acid is
- a)  b)  c)  d) 

Linked Comprehension Type Questions

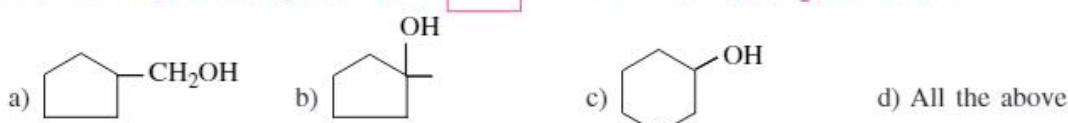
Passage-I :

The reaction of amines with $\text{NaNO}_2 + \text{HCl}$ depends on the type of the amine and whether it is aliphatic or aromatic. The diazo group developed in aliphatic primary amines is rather unstable and decompose to produce mainly alcohols. Secondary amines react to give yellow oily liquids.

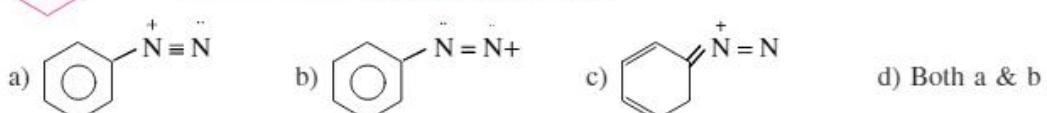
11. Which of the following amines give yellow oily liquid nitroso compounds on reaction with $\text{NaNO}_2 + \text{HCl}$.



12. The alcohol produced by reaction of  with $\text{NaNO}_2 + \text{HCl}$ is/are



13.  $\xrightarrow{\text{NaNO}_2 + \text{HCl}}$ product structure is



Passage-II:

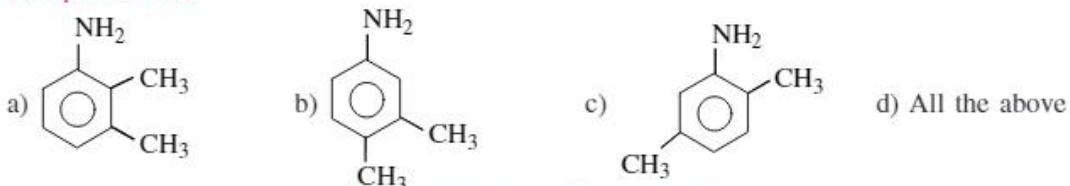
A, B, C are with molecular formula $\text{C}_8\text{H}_{11}\text{N}$ three isomeric amines. A and B react with $\text{CHCl}_3 + \text{KOH}$ but not C. C reacts with $\text{NaNO}_2 + \text{HCl}$ to give yellow oily liquid. A and B on treatment with Br_2 and acetic acid separately produced compounds D ($\text{C}_8\text{H}_9\text{NBr}_2$) and E ($\text{C}_8\text{H}_8\text{NBr}_3$).

14. The name of compound B is likely to be
 a) 3,4-dimethyl aniline b) 3,5-dimethyl aniline c) 4-Ethyl aniline d) 2,6-dimethyl aniline

15. Compound C may be



16. Compound A is



Matrix Matching Type Questions

17. Column-I

- | | |
|--------------------------|---|
| A) Hofmann degradation | p) Aldehyde + 1° amine |
| B) Curtius rearrangement | q) Isocyanate |
| C) Lossen rearrangement | r) $\text{Br}_2 + \text{NaOH}$ |
| D) Hemiaminal | s) $\text{R}-\overset{\text{ }}{\underset{\text{O}}{\text{C}}}-\text{N}_3$ |

18. Column-I

- | | |
|----|---|
| A) | p) Reacts with nitrous acid |
| B) | q) Undergoes azo coupling reaction with diazonium salts |
| C) | r) Undergoes electrophilic substitution |
| D) | s) Reacts with hydrochloric acid to form salt |
| | t) Gives carbylamine test with CHCl_3 & KOH |

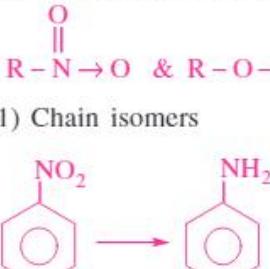
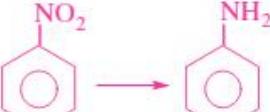
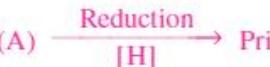
EXERCISE-V

*(Nitrobenzene, Diazonium salts, Cyanides and Isocyanides
Introduction, Preparation and Properties)*

LEVEL-I (MAIN)

Straight Objective Type Questions

1. Nitrobenzene is reduced with LiAlH_4 . The product is
 1) Azobenzene 2) Hydrazobenzene
 3) N-Phenyl hydroxylamine 4) Aniline

2. Among the following which is less reactive towards electrophilic substitution reactions
 1) Benzene 2) Nitrobenzene 3) Aniline 4) Toluene
3. Nitrobenzene is used as a solvent in
 1) Wurtz's reaction 2) The preparation of Grignard reagent
 3) Friedel-Craft's reaction 4) Diazotisation reaction
4. 
 $\text{R}-\overset{\text{O}}{\underset{\parallel}{\text{N}}} \rightarrow \text{O}$ & $\text{R}-\text{O}-\text{N}=\text{O}$ are a pair of
 1) Chain isomers 2) Metamers 3) Functional isomers 4) Tautomers
5.  Here the reagent is
 1) $\text{Zn} + \text{NH}_4\text{Cl}$ 2) $\text{Zn} + \text{NaOH}$ 3) $\text{Sn} + \text{HCl}$ 4) LiAlH_4
6.  the main product of the reaction
 1) Nitrobenzene 2) o-dinitrobenzene 3) m-dinitrobenzene 4) p-dinitrobenzene
7. Azobenzene can be obtained by reducing nitrobenzene with
 1) $\text{Sn} + \text{HCl}$ 2) $\text{Fe} + \text{HCl}$ 3) NH_4Cl 4) LiAlH_4
8. Which of the following give(s) aniline by reduction of nitrobenzene?
 1) H_2/Ni 2) Sn/HCl 3) Both 1 & 2 4) LiAlH_4
9. Hydrazobenzene can be obtained by reducing nitrobenzene with
 1) $\text{Sn} + \text{HCl}$ 2) $\text{Fe} + \text{HCl}$ 3) $\text{Zn} + \text{NH}_4\text{Cl}$ 4) $\text{Zn} + \text{NaOH}$
10. (A)  Primary amine. The compound (A) may be
 1) Alkyl cyanide 2) Acid amide 3) 1⁰-nitroalkane 4) All
11. In benzene diazonium chloride, the functional group is
 1) $-\text{N} = \text{N} = \text{Cl}$ 2) $-\text{N} = \text{N}^+ - \text{Cl}^-$ 3) $-\text{N}^+ = \text{N} - \text{Cl}^-$ 4) $-\overset{+}{\text{N}} \equiv \overset{\cdot\cdot}{\text{N}}$
12. Diazonium salts are formed by
 1) Aliphatic primary amines 2) Aromatic primary amines
 3) Alicyclic primary amines 4) Heterocyclic aromatic nitrogen compounds
13. Diazotisation means the conversion of
 1) Any primary amine into diazonium salt using $\text{NaNO}_2 + \text{HCl}$ at ice cold temperature
 2) aromatic primary amine into diazonium salt using $\text{NaNO}_2 + \text{HCl}$ at $60-70^\circ\text{C}$
 3) aromatic primary amine into diazonium salt using $\text{NaNO}_2 + \text{HCl}$ at ice cold temperature
 4) Any primary amine into diazonium salt using $\text{NaNO}_3 + \text{HCl}$ at ice cold temperature
14. Which of the following does not give diazonium salt with nitrous acid at 273K?
 1) Benzenamine 2) Benzyl amine 3) p-hydroxy aniline 4) o-hydroxy aniline
15. Which diazonium salt is stable at room temperature?
 1) Benzene diazonium chloride 2) Benzene diazonium fluoroborate
 3) Benzene diazonium nitrate 4) Benzene diazonium bromide

16. Conversion of benzene diazonium salt into chlorobenzene in presence of Cu_2Cl_2 is called
 1) Azocoupling reaction 2) Sandmeyer reaction
 3) Gattermann reaction 4) Shiemann reaction
17. Action of KI on Benzene diazonium chloride yields
 1) Sym triiodobenzene 2) p-diiodobenzene 3) o-di iodobenzene 4) iodobenzene
18. Benzene diazonium fluoro borate on heating to dryness yields
 1) Fluorobenzene 2) Benzene 3) Aniline 4) o-fluoroaniline
19. $\text{Ar.N}_2\text{Cl} \xrightarrow{\text{dil.H}_2\text{SO}_4} \text{X} + \text{N}_2 + \text{HCl}$ where regarding X, correct statement is
 1) dissolves in NaOH solution 2) It liberates H_2 with Na
 3) It is stronger acid than acetic acid 4) 1 and 2
20. During diazo coupling, the following group is retained
 1) $-\text{N} = \text{N}-$ 2) $-\text{N} \equiv \text{N}-$ 3) NH_2 4) NHR'
21. Which of the following is an example of electrophilic substitution?
 1) diazotisation 2) Sandmayer reaction
 3) diazo coupling 4) action of KCN on ArN_2Cl
22. Benzenediazonium salt on reaction with phenol gives
 1) p-hydroxyazobenzene 2) o-hydroxyazobenzene
 3) m-hydroxyazobenzene 4) p-aminoazobenzene
23. N,N-dimethyl aniline on coupling with $\text{C}_6\text{H}_5\text{N}_2\text{Cl}$ yields.
 1) 4-(N,N-dimethyl) amino azo benzene 2) 4-(N,N-dimethyl) nitroso benzene
 3) 4-(N,N-dimethyl) amino azoxy benzene 4) 4-(N,N-dimethyl) amino hydrazo benzene
24. On warming an aqueous solution of benzene diazonium chloride, the product obtained is
 1) Benzene 2) Aniline 3) Phenol 4) amide

Numerical Value type Questions

25. The number of hydrogen atoms required to convert 1 mole of nitrobenzene to hydrazobenene is
 26. One mole benzene diazonium chloride is treated with HBr(excess) in the presence of CuBr. Now volume of N_2 liberated at STP weighs

LEVEL-II (ADVANCED)Straight Objective Type Questions

1. Nitrobenzene on reduction with Hydrogen in presence of Nickel gives
 a) Azobenzene b) Hydrazobenzene c) Phenyl hydroxyl amine d) Aniline
2. Nitrobenzene \rightarrow Hydrazobenzene. Here the reagent is
 a) $\text{Sn} + \text{HCl}$ b) $\text{Zn} + \text{NH}_4\text{Cl}$ c) $\text{Zn} + \text{Aq.NaOH}$ d) LiAlH_4

3. In the reaction The equivalent weight of Nitrobenzene is
 a) M b) $\frac{M}{2}$ c) $\frac{M}{4}$ d) $\frac{M}{6}$

4. The ratio of the number of hydrogen atoms required to get 1 mole of azobenzene and 1 mole of hydrazobenzene



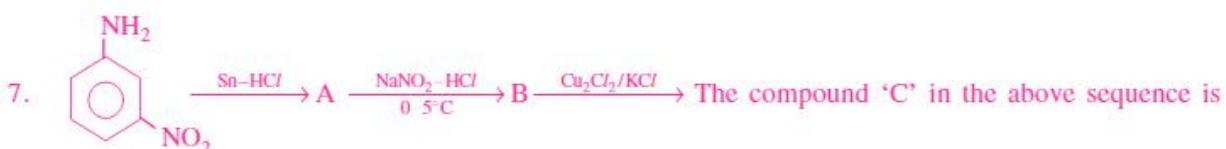
- a) 4 : 5 b) 5 : 4 c) 1 : 1 d) 2 : 3

5. Which of the following methods is used to prepare aniline on large scale?

- a) $\text{C}_6\text{H}_5\text{NO}_2 + 6(\text{H}) \xrightarrow{\text{Fe/H}_3\text{O}^+} \text{C}_6\text{H}_5\text{NH}_2 + 2\text{H}_2\text{O}$
 b) $\text{C}_6\text{H}_5\text{NO}_2 + 6(\text{H}) \xrightarrow{\text{Sn/HCl}} \text{C}_6\text{H}_5\text{NH}_2 + 2\text{H}_2\text{O}$
 c) $\text{C}_6\text{H}_5\text{OH} + \text{NH}_3 \xrightarrow[300^\circ\text{C}]{\text{ZnCl}_2} \text{C}_6\text{H}_5\text{NH}_2 + \text{H}_2\text{O}$
 d) $\text{C}_6\text{H}_5\text{Cl} + 2\text{NH}_3 \xrightarrow{\text{Cu}_2\text{O}, 200^\circ\text{C}} \text{C}_6\text{H}_5\text{NH}_2 + \text{NH}_4\text{Cl}$

6. $\text{CCl}_3 - \text{NO}_2$ can be obtained by

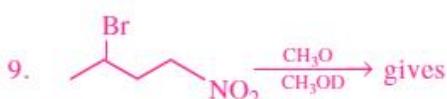
- a) $\text{CH}_3\text{---NO}_2$ reaction with PCl_5
 b) $\text{CH}_3\text{---NO}_2$ reaction with Cl_2 in presence of NaOH
 c) CHCl_3 reaction with HNO_3
 d) CH_3COOH reacts with HNO_3

- 7.
- 
- The compound 'C' in the above sequence is

- a) b) c) d)

8. Which of the following give (S) chloropicrin on chlorination?

- a) $\text{CH}_3\text{---NO}_2$ b) $\text{CH}_3\text{---CH}_2\text{---NO}_2$ c) d) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2$

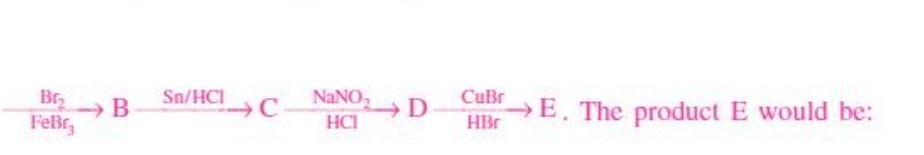
- 9.
- 
- gives

- a) b) c) d)

10. Which of the following is soluble in NaOH ?

- a) Aniline b) $\text{CH}_3\text{---CH}_2\text{---NO}_2$ c) d)

11. In a set of reaction p-nitrotoluene yielded a produce E



- The product E would be:
- a)
 - b)
 - c)
 - d)

12. Reaction of m-dinitro benzene with $(\text{NH}_4)_2\text{S}$ gives

- a)
- b)
- c)
- d)

13. $\xrightarrow{\text{Sn-HCl}} \text{A} \xrightarrow{\text{NaOH}} \text{Structure of aniline: A benzene ring with an NH2 group attached.}$

A in the above sequence is

- a)
- b)
- c)
- d)

14. Aniline can be converted into Benzene by

- a) diazotization
- b) diazotization followed by treating with H_3PO_2
- c) treating with H_3PO_2
- d) diazotization followed by treating with steam

15. Action of HCl on Benzene diazonium chloride in the presence of copper powder gives

- a) p-chloro benzene diazonium chloride
- b) o-chloro benzene diazonium chloride
- c) Chloro benzene
- d) o-dichloro benzene

16. Benzene diazonium chloride on reaction with KCN in the presence of CuCN yields X, X on hydrolysis yields Y. Now, Y can also be obtained from?

- a) Toluene by the action of $\text{Cl}_2 / \text{FeCl}_3$
- b) Toluene by oxidation by KMnO_4
- c) Toluene by nitration
- d) Toluene by sulphonation

17. Which of the following is the correct order of ease of coupling with $\text{C}_6\text{H}_5\text{N}_2\text{Cl}$?

- | | | | |
|------------------|------------------|------------------|-------------------|
| A) Benzene | B) Nitro benzene | C) Phenol | D) Chloro benzene |
| a) A > D > B > C | b) C > A > B > D | c) C > A > D > B | d) B > D > A > C |

18. Which compound/s does not give stable diazotisation product

- a) $\text{C}_6\text{H}_5\text{NH}_2$
- b) $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$
- c)
- d)

19. The amine which liberate nitrogen on reaction with nitrous acid is

- a) Isopropyl amine
- b) N-Methyl aniline
- c) Isobutyl amine
- d) tert-butylamine

20. Which of the following aryl amines will not form a diazonium salt on reaction with sodium nitrite in hydrochloric acid?

- a) N,N-Dimethylaniline b) p-Amino acetophenone
c) 4-Chloro-N-methyl aniline d) N-Ethyl-2-methyl aniline

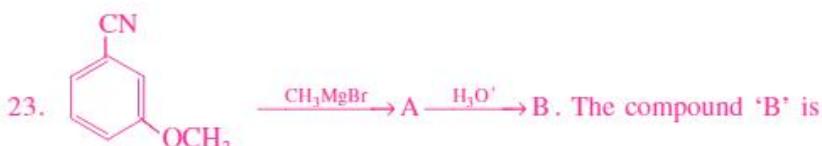


Among these cations, the correct order of the indicated C – N bond strength is

- a) III > I > II b) II > III > I c) I > II > III d) II > I > III

22. Which of the following amines react with $\text{NaO}_2 + \text{HCl}$ to give yellow oily liquid product(S)

- a) $\text{C}_6\text{H}_5\text{NHCH}_3$ b) $\text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3$ c) $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$ d) $\text{C}_6\text{H}_5\text{NH}_2$



- a) b) c) d)

24. Which sequence of reactions is useful to prepare 1-propanamine

- a) $\text{CH}_3\text{CH}_2\text{CN} \xrightarrow{\text{LiAlH}_4}$
b) $\text{CH}_3\text{CH}_2\text{Cl} \xrightarrow{\text{AgCN}} \xrightarrow{\text{LiAlH}_4}$
c) $\text{CH}_3\text{Cl} \xrightarrow{\text{KCN}} \xrightarrow{\text{LiAlH}_4}$
d) $\text{CH}_3\text{Cl} \xrightarrow{\text{AgCN}} \xrightarrow{\text{LiAlH}_4}$

Linked Comprehension Type Questions

Passage :

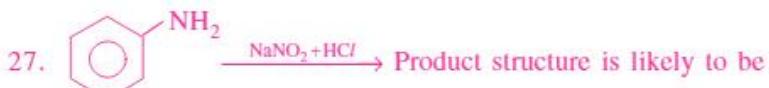
The reaction of amines with $\text{NaNO}_2 + \text{HCl}$ depends on the type of the amine and whether it is aliphatic or aromatic. The diazo group developed in aliphatic primary amines is rather highly unstable and decompose to produce mainly alcohols. Secondary amines react to give yellow oily liquids.

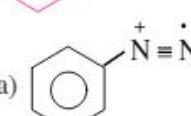
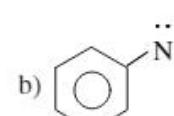
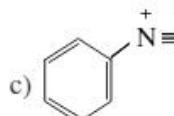
25. Which of the following amines give yellow oily liquid nitroso compounds on reaction with $\text{NaNO}_2 + \text{HCl}$.

- a) $\text{CH}_3\text{CH}_2\text{NHCH}_3$ b) c) d) Both a & b

26. The possible alcohol products of $\text{C}_5\text{H}_9\text{NH}_2$ with $\text{NaNO}_2 + \text{HCl}$ are

- a) b) c) d)



- a)  b)  c)  d) All the above

Matrix Matching Type Questions**28. Column-I**

- A) $\text{C}_6\text{H}_5 - \text{NO}_2 \rightarrow \text{C}_6\text{H}_5 - \text{NH}_2$
 B) $\text{C}_6\text{H}_5 - \text{NO}_2 \rightarrow \text{C}_6\text{H}_5 - \text{N} = \text{N} - \text{C}_6\text{H}_5$
 C) $\text{C}_6\text{H}_5 - \text{NO}_2 \rightarrow \text{C}_6\text{H}_5 - \text{NH} - \text{NH} - \text{C}_6\text{H}_5$
 D) $\text{C}_6\text{H}_5 - \text{NO}_2 \rightarrow \text{C}_6\text{H}_5 - \text{NON} - \text{C}_6\text{H}_5$

Column-II

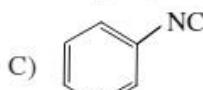
- p) Alkaline medium
 q) Glucose in NaOH
 r) Sn / HCl in acidic medium
 s) Alkaline sodium in basic medium

29. Column-I

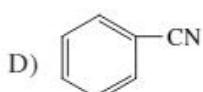
- A) $\text{CH}_3\text{CH}_2\text{CN}$
 B) $\text{CH}_3\text{CH}_2\text{NC}$

Column-II

- p) Undergoes electrophilic substitution
 q) Hydrolysis give primary amine



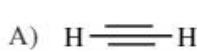
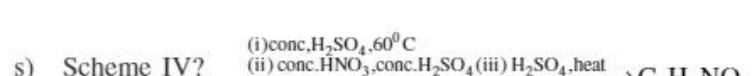
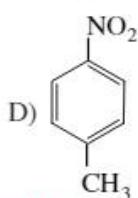
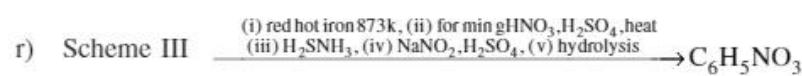
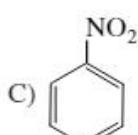
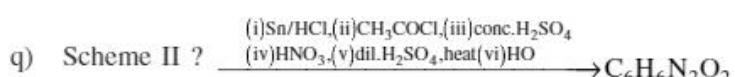
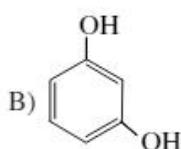
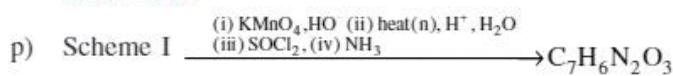
- r) Reduction give primary amine

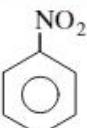


- s) Hydrolysis give formic acid

- t) Reduction give a secondary amine

30. Match the four starting materials (P,Q,R,S) given in List-I with the corresponding reaction schemes (I,II,III,IV) provided in List-II and select the correct answer using the code given below the lists .

Column-I**Column-II**

Integer Type Questions

31. The number of [H] required to reduce with Sn-HCl to give aniline.

32. $\begin{array}{c} \text{CH}_2 - \text{CN} \\ | \\ (\text{CH}_2)_7 \\ | \\ \text{CH}_2 - \text{CN} \end{array} \xrightarrow{\text{H}_3\text{O}^+ \Delta} \text{A}$, the number of oxygen atoms in A

KEY SHEET (LECTURE SHEET)**EXERCISE-I**

- | | | | | | | | | |
|----------------|------|------|------|------|------|------|------|------|
| LEVEL-I | 1) 3 | 2) 3 | 3) 2 | 4) 3 | 5) 1 | 6) 2 | 7) 3 | 8) 4 |
| | 9) 4 | | | | | | | |

- | | | | | | | | | |
|-----------------|------|------|------|------|------|------|--|--|
| LEVEL-II | 1) d | 2) c | 3) d | 4) 2 | 5) 5 | 6) 1 | | |
|-----------------|------|------|------|------|------|------|--|--|

EXERCISE-II

- | | | | | | | | | |
|-----------------|-----------------------------|---------|--------|-------|---------|---------|---------|------|
| LEVEL-I | 1) 4 | 2) 3 | 3) 1 | 4) 4 | 5) 4 | 6) 3 | 7) 4 | |
| LEVEL-II | 1) c | 2) d | 3) c | 4) a | 5) d | 6) c | 7) a | 8) d |
| | 9) d | 10) abc | 11) ac | 12) d | 13) acd | 14) abd | 15) abc | |
| | 16) A-pqr; B-pqr; C-qr; D-s | | | 17) 3 | | | | |

EXERCISE-III

- | | | | | | | | | |
|----------------|------|-------|------|------|------|------|------|------|
| LEVEL-I | 1) 4 | 2) 3 | 3) 3 | 4) 3 | 5) 3 | 6) 4 | 7) 2 | 8) 2 |
| | 9) 3 | 10) 2 | | | | | | |

- | | | | | | | | | |
|-----------------|------|-------|-------|------|------|------|------|------|
| LEVEL-II | 1) a | 2) c | 3) a | 4) a | 5) a | 6) d | 7) d | 8) b |
| | 9) b | 10) b | 11) b | | | | | |

EXERCISE-IV

- | | | | | | | | | |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| LEVEL-I | 1) 3 | 2) 1 | 3) 3 | 4) 2 | 5) 1 | 6) 1 | 7) 4 | 8) 1 |
| | 9) 2 | 10) 4 | 11) 2 | 12) 1 | 13) 3 | 14) 4 | 15) 4 | 16) 1 |
| | 17) 3 | 18) 2 | 19) 2 | | | | | |

- | | | | | | | | | |
|-----------------|--------------------------|------------------------------------|-------|-------|-------|-------|-------|-------|
| LEVEL-II | 1) d | 2) d | 3) b | 4) a | 5) a | 6) b | 7) d | 8) c |
| | 9) c | 10) c | 11) d | 12) d | 13) a | 14) b | 15) b | 16) d |
| | 17) A-qr; B-qs; C-q; D-p | 18) A-pqr; B-pqrst; C-pqrs; D-pqrs | | | | | | |

EXERCISE-V

- | | | | | | | | | |
|----------------|-------|----------|-------|-------|-------|-------|-------|-------|
| LEVEL-I | 1) 1 | 2) 2 | 3) 3 | 4) 3 | 5) 3 | 6) 3 | 7) 4 | 8) 3 |
| | 9) 4 | 10) 4 | 11) 4 | 12) 2 | 13) 3 | 14) 2 | 15) 2 | 16) 2 |
| | 17) 4 | 18) 1 | 19) 4 | 20) 1 | 21) 3 | 22) 1 | 23) 1 | 24) 3 |
| | 25) 5 | 26) 22.4 | | | | | | |

LEVEL-II

- 1) d 2) c 3) d 4) a 5) a 6) bc 7) c 8) a
 9) c 10) bc 11) b 12) a 13) b 14) b 15) b 16) b
 17) c 18) b 19) acd 20) acd 21) d 22) ab 23) a 24) a
 25) d 26) abc 27) d 28) A-r; B-s; C-p; D-pq
 29) A-r; B-qst; C-pqst; D-pr 30) A-r; B-s; C-q; D-p 31) 6 32) 4

 **PRACTICE SHEET** 
 **EXERCISE-I** 

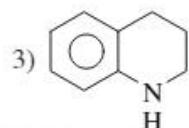
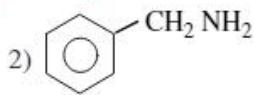
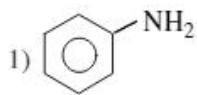
(Classification, Nomenclature & Isomerism)

LEVEL-I (MAIN)
Straight Objective Type Questions

- Which of the following statements is wrong?
 I) amines possess pyramidal shape II) amines act as Bronsted bases
 III) 1^0 amines show metamerism IV) 2^0 amines show metamerism
 1) I, II 2) II, and IV
 3) III only 4) I, II and IV
- N,N-dimethyl butanamine-2** contains
 1) six sp^3 hybridised carbon atoms 2) seven sp^3 hybridised atoms
 3) two sp^3 hybridised nitrogen atoms 4) 1 and 2 are correct
- Primary amino group is absent in
 1) p-amino phenol 2) o-amino phenol
 3) N-methyl ethanamine 4) phenyl amine
- (A) : n-propyl amine is 1^0 but isopropyl amine is 2^0 amine.
 (R) : n-propyl amine and isopropyl amine are position isomers.
 1) A and R are true and R explains A 2) A and R are true but R does not explain A
 3) A is true but R is false 4) A is false and R is true
- N,N-dimethyl butanamine-2** is the functional isomer of
 1) N-butanamine-2 2) N-methyl-2-ethyl butanamine-2
 3) trimethyl amine 4) triethyl amine
- n-butyl amine and isobutyl amine are _____ isomers
 1) optical 2) functional 3) chain 4) position
- Which of the following biologically active compounds contains secondary amino group
 1) Adrenaline 2) Ephedrine 3) Proline 4) All the above
- Which of the following is a primary amine
 1) $CH_3CH_2CH_2NH_2$ 2) $CH_3 - \underset{NH_2}{\overset{|}{CH}} - CH_3$ 3) $(CH_3)_2C - NH_2$ 4) All the above

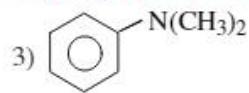
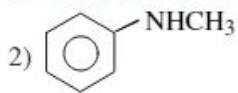
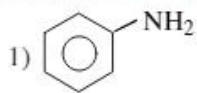
9. The type of hybridisation of nitrogen in aliphatic amines is
 1) sp^3 2) sp^2 3) sp 4) Unhybridised

10. Which of the following is an arylamine



4) Both 1 & 3

11. In which of the following amines, intermolecular hydrogen bond does not exist



4) $\text{CH}_3\text{CH}_2\text{NH}_2$

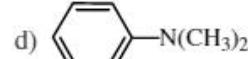
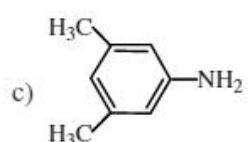
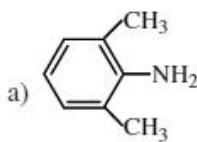
Numerical Value Type Questions

12. The number given as per IUPAC on Nitrogen atom linked to sugar moiety in heterogeneous bases Adenine and Thymine in nucleotide respectively are
 13. A sequence of how many nucleotides in messenger RNA makes a codon for an amino acid ?

LEVEL-II (ADVANCED)

Straight Objective Type Questions

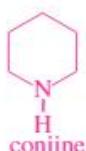
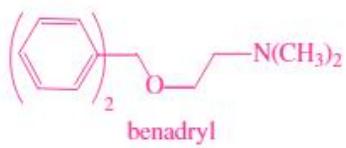
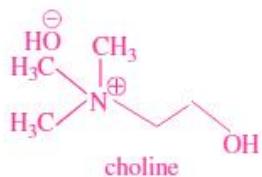
1. Which of the following is likely to have higher boiling point
 a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ b) $(\text{C}_2\text{H}_5)_2\text{NH}$
 c) $\text{CH}_3\text{CH}_2\text{N}(\text{CH}_3)_2$ d) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NHCH}_3$
2. Anisidines are the compounds containing benzene ring in which
 a) – CH_3 & – NH_2 are present b) – CH_3 & – OCH_3 are present
 c) – OCH_3 & NO_2 are present d) – OCH_3 & – NH_2 are present
3. Which of the following statements is wrong
 a) All amines are considered as Lewis bases
 b) All primary amines exhibit functional isomerism
 c) All secondary amines exhibit functional isomerism
 d) All tertiary amines exhibit functional isomerisms
4. Which of the following is N,N-dimethylaniline?



5. Ethylmethylamine cannot be resolved under normal conditions. Why?

- a) The favored configuration is not chiral.
 b) It isomerizes rapidly with the achiral isomer trimethylamine.
 c) The nitrogen atom rapidly inverts its configuration leading to a racemic mixture.
 d) The C-N bond is not stable under conditions used for resolution

6. The structural formulas of four physiologically active amines are given below. Which of these would be classified as a tertiary amine?

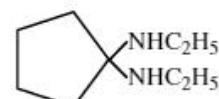
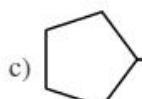
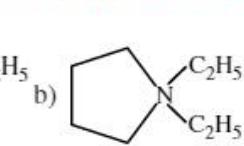
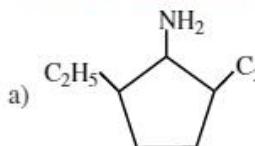


- a) Choline b) Benzedrine c) Benadryl d) Coniine

7. $\text{CH}_3\text{CH}_2\text{CONHCH}_2\text{CH}_2\text{CH}_3$ is

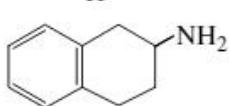
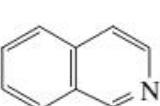
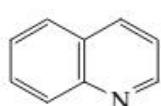
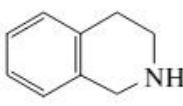
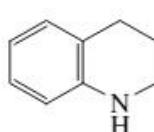
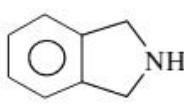
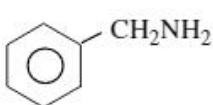
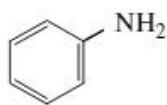
- a) N-Ethylethanamide b) Hexanamide c) N-Propylpropanamide d) N-Ethylhexanamide

8. Which of the following compounds is cyclopentyldiethylamine?



Integer Type Questions

9. The number of monocyclic heterocyclic amines possible for $\text{C}_4\text{H}_9\text{N}$ is (exclude stereoisomers)
10. The number of cyclic primary amines possible for $\text{C}_4\text{H}_9\text{N}$ (exclude stereoisomers)
11. The number of p-disubstituted benzene derivations of $\text{C}_9\text{H}_{13}\text{N}$ is
12. The number of amines which behave like aliphatic amines from the following list is



EXERCISE-II

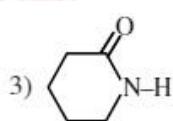
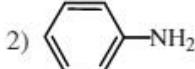
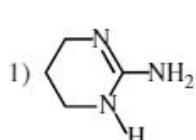
(Basic nature)

LEVEL-I (MAIN)

Straight Objective Type Questions

1. Which of the following is highly basic in aqueous solution
- 1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
 - 2) $\text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3$
 - 3) $(\text{CH}_3)_4\text{N}^+\text{OH}^-$
 - 4) $\text{CH}_3\text{CH}_2\text{N}(\text{CH}_3)_2$
2. Which of the statements is wrong
- 1) All primary amines are basic
 - 2) Aliphatic amines are more basic than ammonia
 - 3) Aliphatic amines are less basic than aromatic amines
 - 4) All aromatic amines are basic

3. Which of the following statements is correct
- Methyl amine is more basic than aniline
 - Aniline is more basic than ammonia
 - Ammonia is more basic than aliphatic amines
 - Aromatic amines have almost same basic nature as aliphatic amines
4. Arrange p-methylaniline (I), m-methyl aniline (II), aniline (III), o-methyl aniline (IV), in the order of basicity.
- I > II > III > IV
 - IV > III > II > I
 - II > I > III > IV
 - I > III > II > IV
5. Which of the following is the strongest Brønsted base?

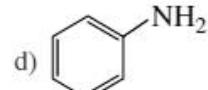
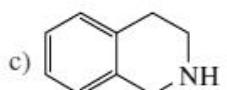
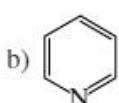
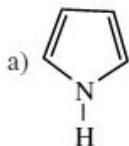


LEVEL-II (ADVANCED)

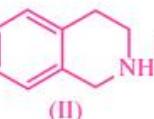
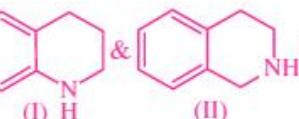
Straight Objective Type Questions

1. Which of the following is the weakest Bronsted base?
- a)
- b)
- c)
- d)
2. Which of the following aniline derivatives is the strongest base?
- a)
- b)
- c)
- d)
3. Which of the following compounds is the strongest acid?
- a)
- b)
- c)
- d)
4. Which of the following contains most basic nitrogen?
- a)
- b)
- c)
- d)
5. Which of the following have highest pK_a value?
- a)
- b)
- c) NH_3
- d)

6. Which of the following is more basic



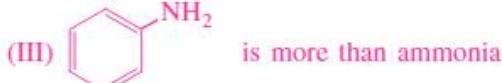
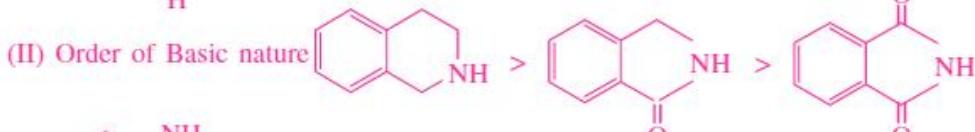
7. Which of the following statements regarding & is true



- a) I is more basic than II
c) I and II are equally basic

- b) I is less basic than II
d) I and II are not basic

8. Consider the following



- a) All statements I, II, III are correct
c) I & III are wrong, II is correct
- b) II is wrong I and III are correct statements
d) I, II, III are all false

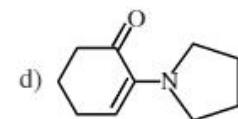
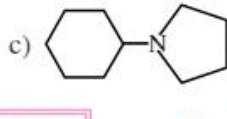
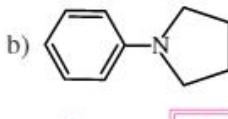
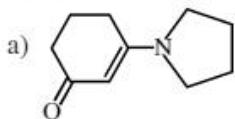
9. I) Tertiary amines do not form intermolecular hydrogen bonds.

II) All amines form H-bonds with water

III) Amines are higher boiling than alcohols and carboxylic acids of comparable molecular weights

- a) I & II are wrong, III is right
c) I & II are right, III is wrong
- b) I & III are right, II is wrong
d) II is right I, III are wrong

10. Which of the following is the weakest Bronsted base?



EXERCISE-III

(Preparation)

LEVEL-I (MAIN)

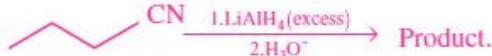
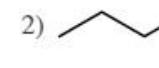
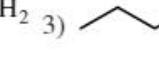
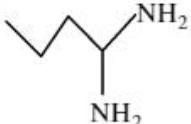
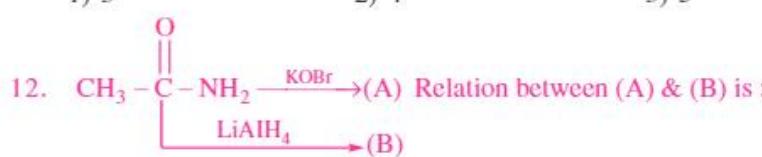
Straight Objective Type Questions

1. Acetamide is treated separately with the following reagents. Which one of these would give methylamine ?

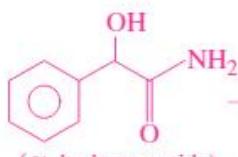
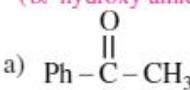
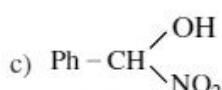
- 1) PCl_5 2) $\text{NaOH} + \text{Br}_2$ 3) Sodalime 4) Hot conc. H_2SO_4

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

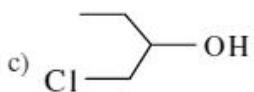
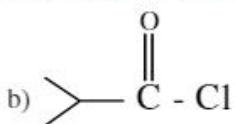
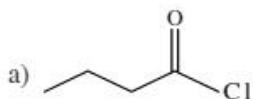
- 1) $\text{R}-\text{X} + \text{NH}_3 \rightarrow$ 2) $\text{R}-\text{CH}=\text{NOH} [\text{H}] \xrightarrow{\text{C}_2\text{H}_5\text{OH}} \text{Na}$
 3) $\text{R}-\text{CN} + \text{H}_2\text{O} \xrightarrow{\text{H}^+}$ 4) $\text{R}-\text{CONH}_2 + 4 [\text{H}] \xrightarrow{\text{LiAlH}_4}$

3. Which one of the following is produced by reduction of RCN in sodium and alcohol ?
 1) RCONH₂ 2) RCOO⁻NH₄⁺ 3) RCH₂NH₂ 4) (RCH₂)₃N
4. The reaction by which a primary amine is formed from a primary amide is called
 1) Hofmann reaction 3) Gabriel phthalimide reaction
 2) Carbylamine reaction 4) Liebermann nitrosoamine reaction
5. Treatment of ammonia with excess of ethyl iodide will yield
 1) Diethylamine 2) Ethylamine
 3) Triethylamine 4) Tetraethylammonium iodide
6. Which of the following gives primary amine on reduction ?
 1) CH₃CH₂NO₂ 2) CH₃CH₂-O-N-O 3) (CH₃)₂CNO₂ 4) (CH₃)₂CHNO₂
7. Gabriel phthalimide reaction is used for preparation of
 1) Primary aromatic amines 2) Primary aliphatic amines
 3) Primary aliphatic amines 4) Tertiary amines
8. Which of the following reactions will not give a primary amine ?
 1) CH₃CONH₂ $\xrightarrow{\text{Br}_2/\text{KOH}}$ 2) CH₃CN $\xrightarrow{\text{LiAlH}_4}$
 3) CH₃NC $\xrightarrow{\text{LiAlH}_4}$ 4) CH₃CONH₂ $\xrightarrow{\text{LiAlH}_4}$
9. When acetamide is treated with NaOBr, the product formed is
 1) CH₃CN 2) CH₃COBr 3) CH₃NH₂ 4) CH₃OH
10. Choose the appropriate product for this reaction. 
 1)  2)  3)  4) 
11. R-C(=O)-NH₂ + xNaOH + Br₂ \rightarrow R-NH₂ + 2NaBr + Na₂CO₃ + H₂O
 Number of moles of NaOH used in above Hoffmann bromamide reaction is :
 1) 3 2) 4 3) 5 4) 6
12. 
 (A) Relation between (A) & (B) is :
 1) Identical 2) Functional isomer 3) Homologous 4) Positional isomers

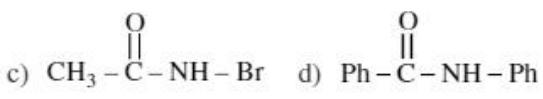
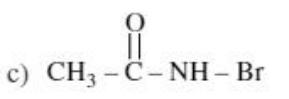
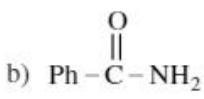
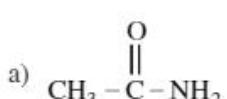
LEVEL-II (ADVANCED)***Straight Objective Type Questions***

1. 
 (α hydroxy amide) $\xrightarrow{\text{Br}_2/\text{KOH}}$ Product; Product of this Hoffmann bromamide reaction is :
 a)  b) Ph-CHO c)  d) Ph-CH₂-NH₂

2. $(X)C_4H_7OCl \xrightarrow{NH_3} C_4H_9ON \xrightarrow[Br_2]{KOH} CH_3CH_2CH_2NH_2$; Compound (X) is :

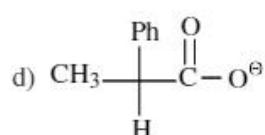
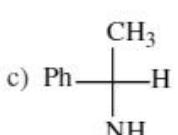
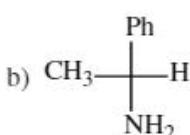
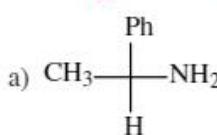


3. Which of the following will not give Hoffmann bromamide reaction ?



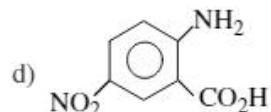
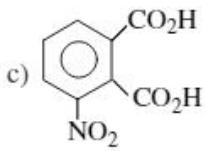
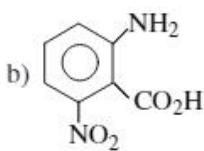
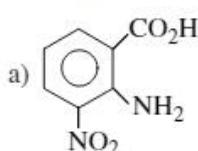
4.

Product of the reaction is:

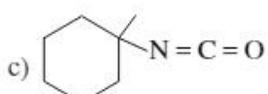
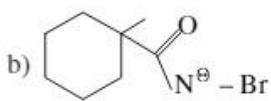
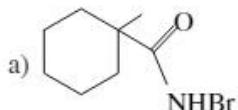
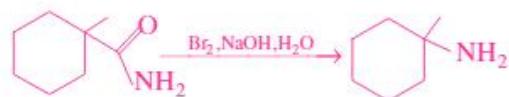


5.

Product X will be:



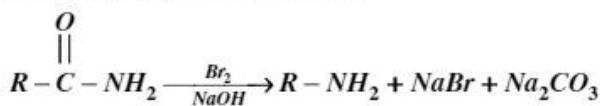
6. Which of the following species would not be involved in the Hoffmann rearrangement shown below?



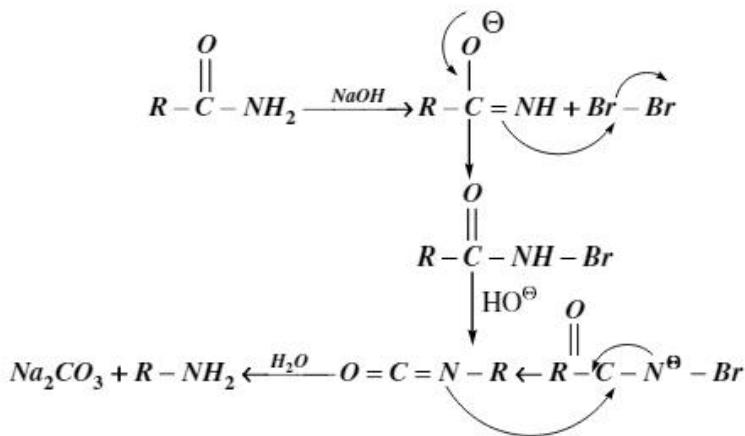
d) All of the above are involved in the reaction

Linked Comprehension Type QuestionsPassage :

Hoffmann bromamide reaction involves conversion of a carboxylic acid amide into an amine with a loss of a carbon atom on treatment with aqueous sodium hypobromite. Thus Hoffmann result in shortening of a carbon chain.



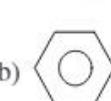
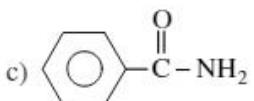
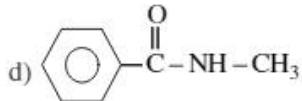
Mechanism of the reaction is:

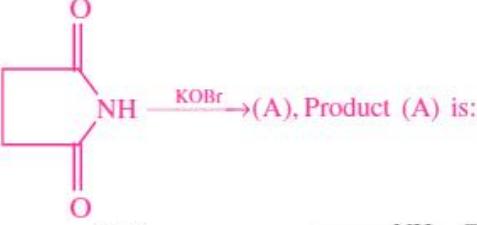
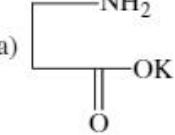
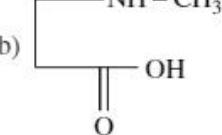
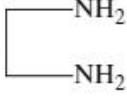


7. Number of moles of NaOH consumed in above reaction.
 a) 1 b) 2 c) 3 d) 4

8.  $\xrightarrow[\text{KOH}]{Br_2}$ (A) (Major):
 a) Ph - NH₂ b) Ph - CH₂ - NH₂ c) Ph - NH - CH₃ d) Ph - N(CH₃)₂

9. Which of the following will not give Hoffmann bromamide reaction.

- a) $\text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2$ b)  c)  d) 

10.  $\xrightarrow{\text{KOB}} \text{(A)}$, Product (A) is:
 a)  b)  c)  d) None of these

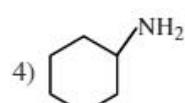
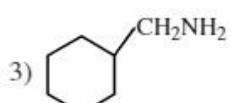
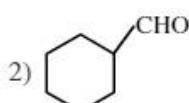
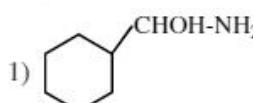
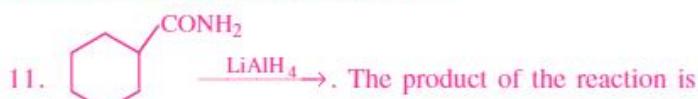
EXERCISE-IV

(Properties)

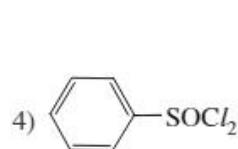
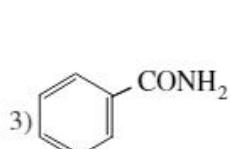
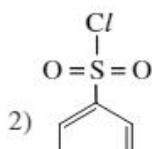
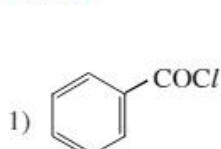
LEVEL-I (MAIN)

Straight Objective Type Questions

1. The following turns brown on exposure to air and light
 - 1) Nitrobenzene
 - 2) m-dinitrobenzene
 - 3) Aniline
 - 4) Benzene diazonium chloride
2. In the preparation of N-phenyl benzene sulphonamide from aniline, the reagent used is
 - 1) H_2SO_4
 - 2) SOCl_2
 - 3) $\text{C}_6\text{H}_5\text{Cl}$
 - 4) $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$
3. Carbylamine test is performed in alcoholic KOH by heating a mixture of
 - 1) Chloroform and silver powder
 - 2) Trihalogenated methane and a primary amine
 - 3) An alkyl halide and a primary amine.
 - 4) An alkyl cyanide and a primary amine.
4. Chlorobenzene can be prepared by reacting aniline with
 - 1) Hydrochloric acid
 - 2) Cuprous chloride
 - 3) Chlorine in the presence of anhydrous aluminium chloride.
 - 4) Nitrous acid followed by heating with cuprous chloride.
5. Hinsberg's reagent is
 - 1) Phenylisocyanide
 - 2) Benzenesulphonyl chloride
 - 3) p-toluenesulphonic acid
 - 4) O-dichlorobenzene
6. Which of the following compounds will dissolve in an alkali solution after it has undergone reaction with Hinsberg reagent?
 - 1) $(\text{C}_2\text{H}_5)_2\text{NH}$
 - 2) $\text{CH}_3 - \underset{\text{CH}_3}{\text{N}} - \text{C}_6\text{H}_5$
 - 3) CH_3NH_2
 - 4) $\text{C}_6\text{H}_5\text{NHC}_6\text{H}_5$
7. The bromination of aniline produces
 - 1) 2- bromoaniline
 - 2) 4-bromoaniline
 - 3) 2, 4, 6-tribromoaniline
 - 4) 2, 6-dibromoaniline
8. Amines can be separated by
 - 1) Fractional distillation
 - 2) Hinsberg's method
 - 3) Solubility test
 - 4) Hofmann's method
9. Which of the following give (s) Schiff's base with aldehydes?
 - 1) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$
 - 2) $\text{C}_6\text{H}_5 - \text{CH}_2 - \text{NH}_2$
 - 3) $\text{C}_6\text{H}_5 - \text{NH}_2$
 - 4) $\text{C}_6\text{H}_5 - \text{NO}_2$
10. Which of the following amines react with $\text{NaNO}_2 + \text{HCl}$ to give yellow oily liquid product(s)
 - 1) $\text{C}_6\text{H}_5\text{NHCH}_3$
 - 2) $\text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3$
 - 3) $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$
 - 4) $\text{C}_6\text{H}_5\text{NH}_2$



12. Mixture of primary, secondary, and tertiary amines are separated by Hinsberg's test. The reagent used is



13. If you wanted to convert 1-bromopentane cleanly to the corresponding primary amine, which reagent or reagents would be the most effective?

- 1) NC^- followed by H_2 and a Ni catalyst.
- 2) NH_3 followed by NaOH
- 3) potassium phthalimide followed by N_2H_4
- 4) NC^- followed by LiAlH_4

14. A chloroform solution of aniline is heated with KOH. Which of the following is right.

- 1) Chloroform hydrolysed to give formic acid
- 2) Aniline reacts with chloroform to give cyanides
- 3) A secondary amine is obtained
- 4) Foul smelling compound is obtained

15. Aniline reacts with benzoyl chloride to give a product. The reaction is known as

- | | |
|-----------------------|--------------------------------|
| 1) Schmidt reaction | 2) Schotten – Baumann reaction |
| 3) Sandmeyer reaction | 4) Hofmann reaction |

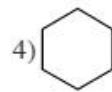
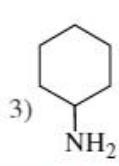
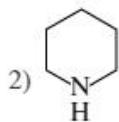
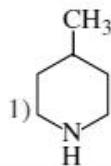
16. One mole of NH_3 is made to react with one mole of CH_3Cl , which of the following is/ are formed

- 1) CH_3NH_2
- 2) $(\text{CH}_3)_2\text{NH}$
- 3) $(\text{CH}_3)_3\text{N}$
- 4) All the above

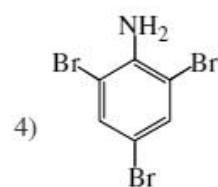
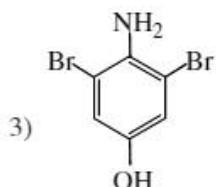
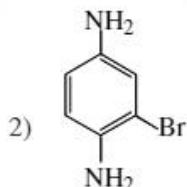
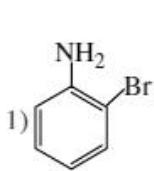
17. Compound having the molecular formula $\text{C}_3\text{H}_9\text{N}$ reacts with benzene sulphonyl chloride to give product which is soluble in NaOH. The compound is

- | | |
|-------------------|--------------------|
| 1) Primary amine | 2) Secondary amine |
| 3) Tertiary amine | 4) Quaternary salt |

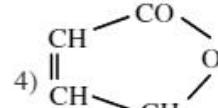
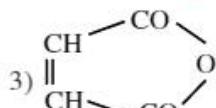
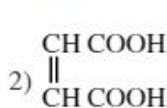
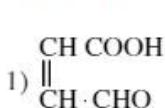
18. Which compound has highest boiling point



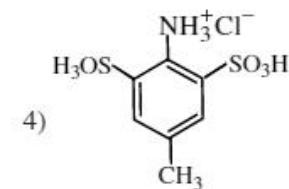
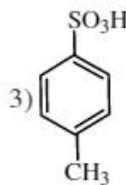
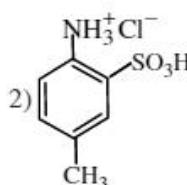
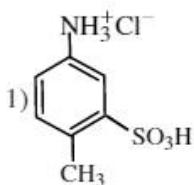
19. Aniline reacts with Br_2 in acetic acid to give



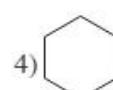
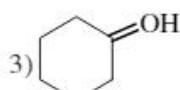
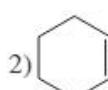
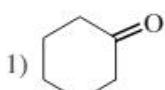
20. $\text{C}_6\text{H}_5\text{NH}_2 + \text{A} \xrightarrow{\text{(i) Ether}} \text{C}_6\text{H}_5\text{NH COOH} = \text{CH COOH}$, The compound A in the above reaction is



21. Which of the following is the major product obtained by sulphonation of



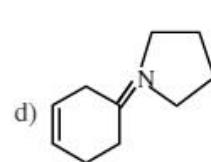
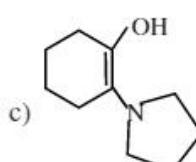
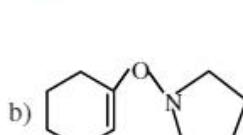
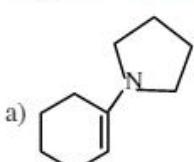
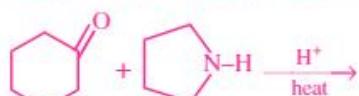
22. $\xrightarrow{\text{HNO}_2}$ A, The Structure of the product is



LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. Which of the following will be the favored product from the reaction shown below?

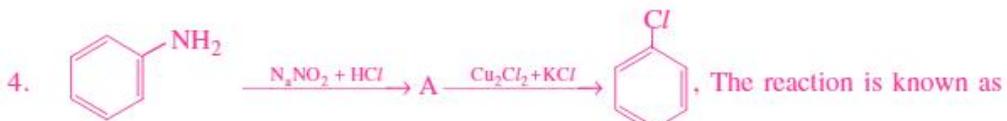


2. A $\text{C}_5\text{H}_{13}\text{N}$ compound gives a base soluble derivative in the Hinsberg test ($\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ in base). Which of the following fits these facts best?

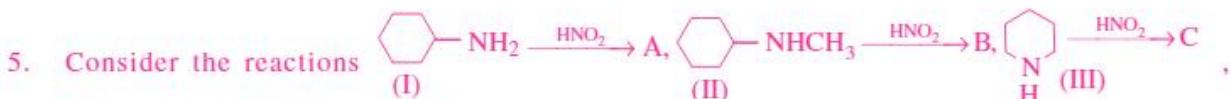
- a) 1,1-Dimethylpropylamine.
c) 2,2-Dimethylpropylamine.

- b) Isopropyldimethylamine.
d) N-Methyl-2-methylpropylamine.

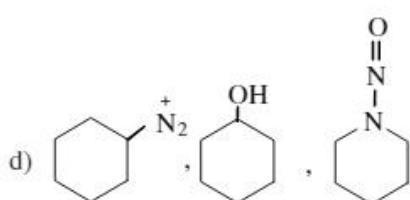
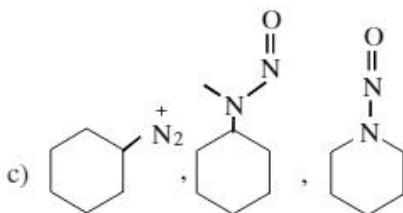
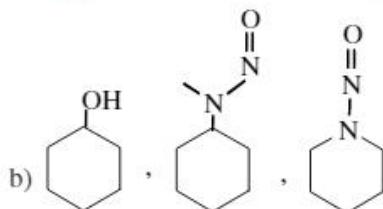
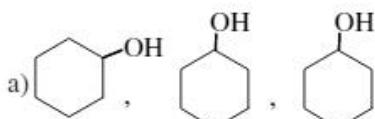
3. Which of the following sequence of reactions convert aniline into chlorobenzene
- Conc. HCl under high P and high T.
 - Sn – HCl, Boiling in H₂O
 - NaNO₂ – HCl, Cu₂Cl₂, KCl
 - HNO₃ – H₂SO₄, Cu₂Cl₂, KCl, Boil in H₂O



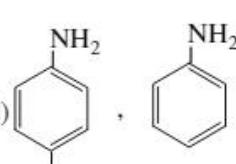
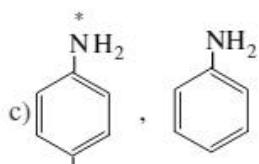
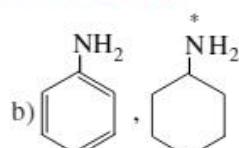
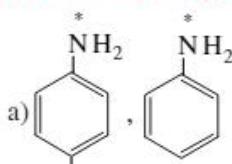
- Shiemann reaction
- Sandmeyer reaction
- Sabatier – Senderen reaction
- Schmidt reaction



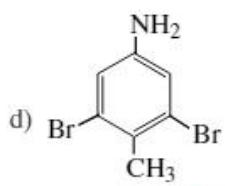
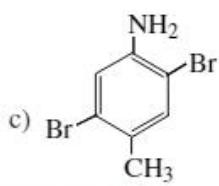
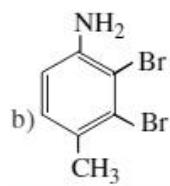
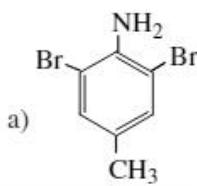
The products A, B, C respectively are



6. Two compounds (I) & (II) are allowed to react with Br₂ in presence of KOH in the same reaction medium. The products obtained are (* indicates nitrogen atom is labelled)



7. p-Toluidine $\xrightarrow{Br_2 - H_2O}$ A. A in the above sequence is

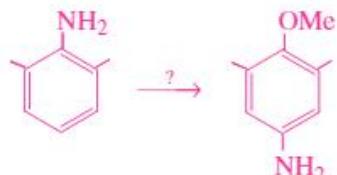


AMINES AND AZO COMPOUNDS

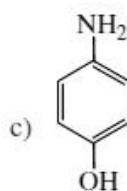
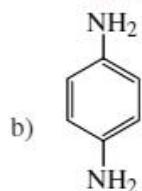
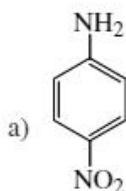
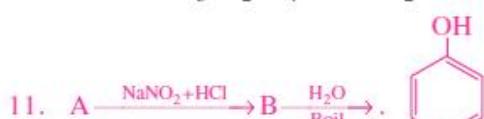
OBJECTIVE CHEMISTRY IIB

8. Which of the following procedures would be best for preparing isobutylisopropylamine, $(\text{CH}_3)_2\text{CHNHCH}_2\text{CH}(\text{CH}_3)_2$?
- $(\text{CH}_3)_2\text{CHBr} + (\text{CH}_3)_2\text{CHCH}_2\text{NH}_2$
 - (i) $(\text{CH}_3)_2\text{CHBr} + (\text{CH}_3)_2\text{CHCONHNa}$ (ii) LiAlH_4 in ether
 - (i) $(\text{CH}_3)_2\text{CHNH}_2 + (\text{CH}_3)_2\text{CHCH = O}$ (ii) H_2 & Pt
 - $(\text{CH}_3)_2\text{CHCN} + (\text{CH}_3)_2\text{CHNH}_2$
9. The Hinsberg test of a $\text{C}_5\text{H}_{14}\text{N}_2$ compound produces a solid that is insoluble in 10% aq. NaOH. This solid derivative dissolves in 10% aq. sulphuric acid. Which of the following would best fit these facts?
- $\text{NH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)_2$.
 - $(\text{CH}_3)_2\text{NCH}_2\text{CH}_2\text{NHCH}_3$.
 - $\text{NH}_2\text{CH}_2\text{C}(\text{CH}_3)_2\text{CH}_2\text{NH}_2$.
 - $(\text{CH}_3)_2\text{NCH}_2\text{N}(\text{CH}_3)_2$.

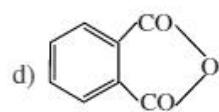
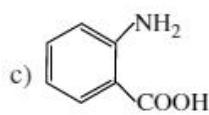
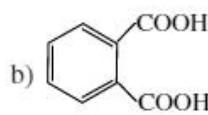
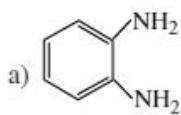
10. How would you accomplish the following synthesis ?

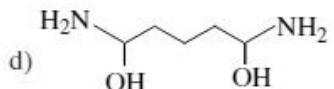
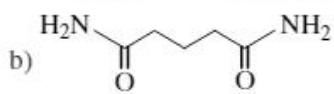
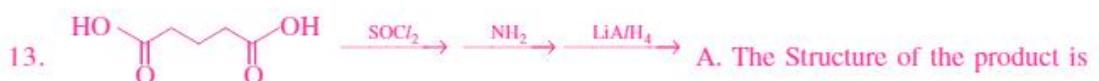


1. $\text{HNO}_3, \text{H}_2\text{SO}_4$ 2. NaOH 3. HONO , ice bath 4. $\text{Cu}_2\text{O}, \text{H}_2\text{O}$
5. NaH 6. MeBr 7. H_2 , catalyst
1. $\text{HNO}_2, \text{H}_2\text{SO}_4$ 2. Fe, HCl 3. NaOH 4. HONO , ice bath
5. $\text{Cu}_2\text{O}, \text{H}_2\text{O}$ 6. $\text{MeONa}, \text{MeBr}$
1. Sn, HCl 2. $\text{HNO}_2, \text{H}_2\text{SO}_4$ 3. HONO , ice bath 4. $\text{Cu}_2\text{O}, \text{H}_2\text{O}$
5. MeONa 6. MeBr
1. HONO , ice bath 2. $\text{Cu}_2\text{O}, \text{H}_2\text{O}$ 3. NaH 4. MeBr
5. $\text{HNO}_3, \text{H}_2\text{SO}_4$ 6. H_2 , catalyst



d) Both b & c



More than One correct answer Type Questions

14. Carbylamine test is used for the detection of primary amine group, which of these is related with carbylamine reaction?



15. Which is/are false about Hinsberg test?

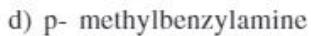
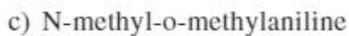
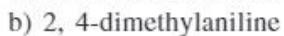
a) 2° amines react with the reagent to form sulphonamide soluble in alkali

b) The hydrogen attached to nitrogen is made more acidic in the primary amine sulphonamides by the electron withdrawing nature of SO_2 group

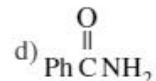
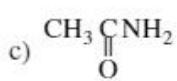
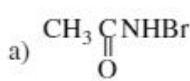
c) Only 1° amine reacts with the reagent to form sulphonamide and not 2° amine, so 3° and 2° amines can be distinguished

d) 3° amine reacts with the reagent and dissolves in alkali to give a clear solution

16. A positive carbylamine test is given by

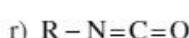
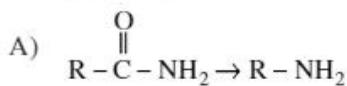


17. Which of the following can give Hofmann bromamide reaction?

Matrix Matching Type Questions

18. Column-I

Column-II

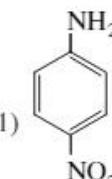
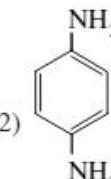
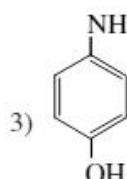
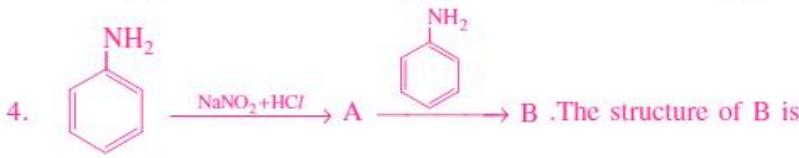
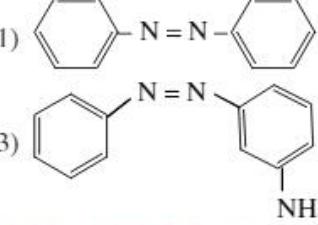
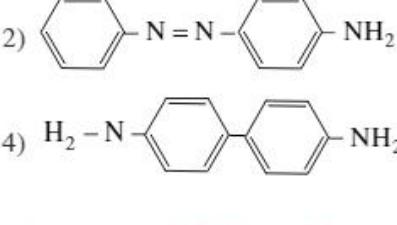
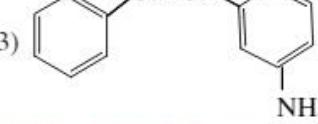
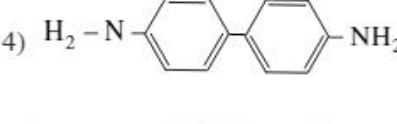
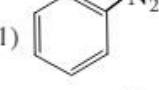
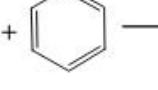
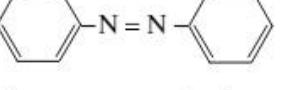
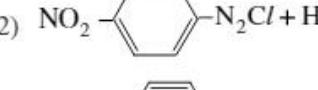
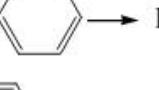
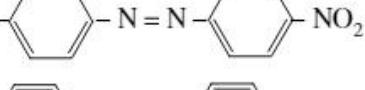
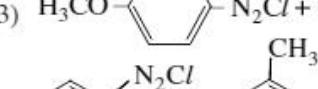
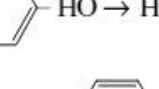
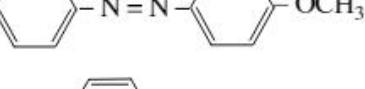
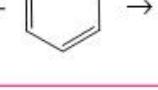
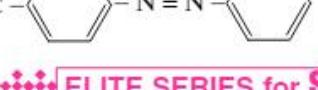


EXERCISE-V

(Nitrobenzene, Diazonium salts, Cyanides and Isocyanides
Introduction, Preparation and Properties)

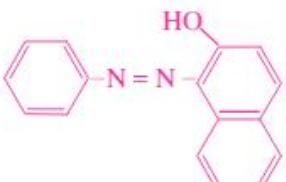
LEVEL-I (MAIN)

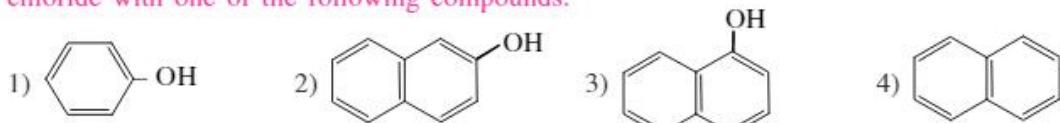
Straight Objective Type Questions

1. A $\xrightarrow{\text{NaNO}_2 + \text{HCl}}$ B $\xrightarrow[\text{Boil}]{\text{H}_2\text{O}}$ 
- 1)  2)  3)  4) Both 2 & 3
2. Reduction of nitrobenzene using LiAlH₄ gives
 1) Azobenzene 2) Hydrazobenzene 3) Aniline 4) Phenylhydroxylamine
3. Which of the following intermediates in Sandmeyer's reaction?
 1) C₆H₅-N[⊕] ≡ N 2) C₆H₅[·] (Phenyl radical) 3) C₆H₅N⁺ ≡ NCl⁻ 4) All
4. 
 1)  2) 
 3)  4) 
5. Which of the following coupling reactions takes place most readily than others
 1)  +  \rightarrow 
 2)  +  \rightarrow 
 3)  +  \rightarrow 
 4)  +  \rightarrow 

6. In the following reaction, $\text{CH}_3\text{NH}_2 + \text{CHCl}_3 + \text{KOH} \rightarrow$ Nitrogen containing compound + $\text{KCl} + \text{H}_2\text{O}$.
The nitrogen containing compound is

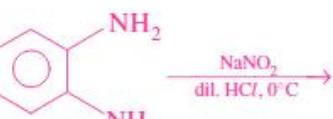


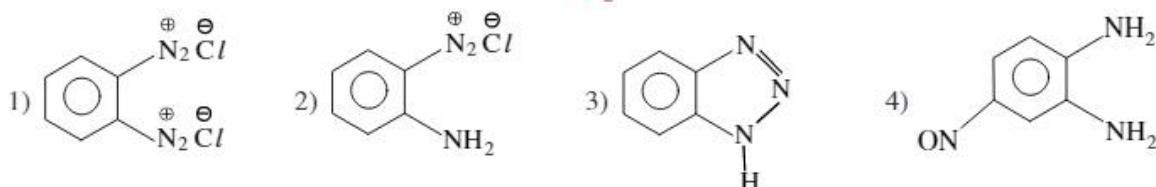
7. The product  Which is a red azo dye obtained on reacting benzene diazonium chloride with one of the following compounds.



8. An organic compound (A) on reduction gives a compound (B) which on reaction with CHCl_3 and NaOH form (C). The compound (C) on catalytic reduction gives N-methylaniline. The compound (A) is

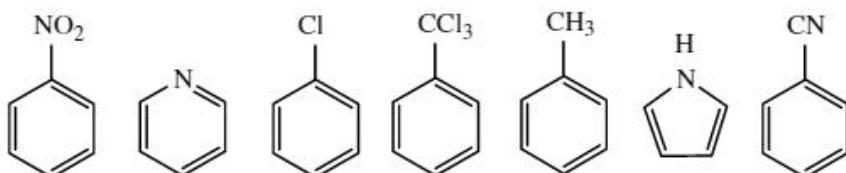


9. The major product of the reaction is 



Numerical Value Type Questions

10. Urea on dry distillation produces an aromatic character acid with release of ammonia. The maximum number of replaceable protons in acid formed are
11. How many of the following compounds have their net dipole moment moving outward from the aromatic ring?

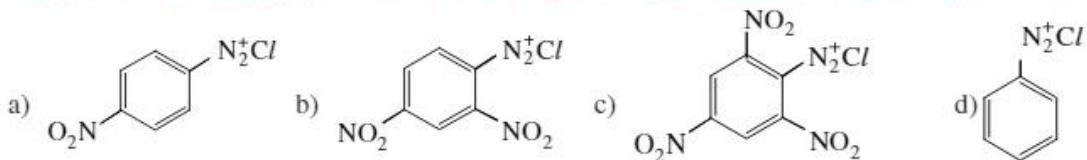


12. Rayons are semi-synthetic fibres made from cellulose. One of such fibre is made by treating cellulose with excess of acetic anhydride. The number of acetate units present per unit of glucose in cellulose acetate is

LEVEL-II (ADVANCED)

Straight Objective Type Questions

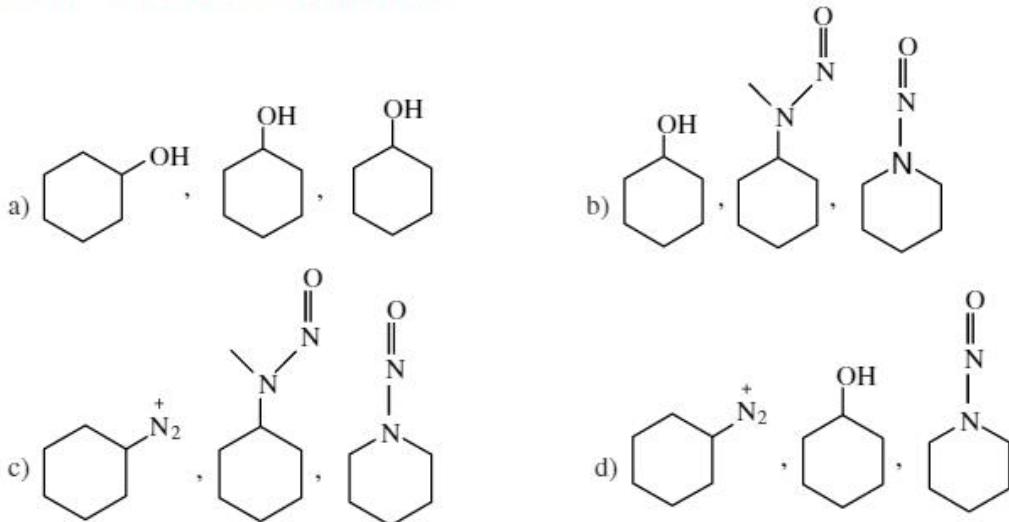
1. Which of the following diazonium salts readily undergo diazo coupling reaction with phenol

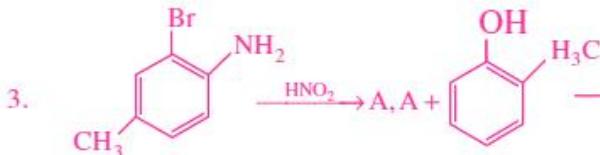


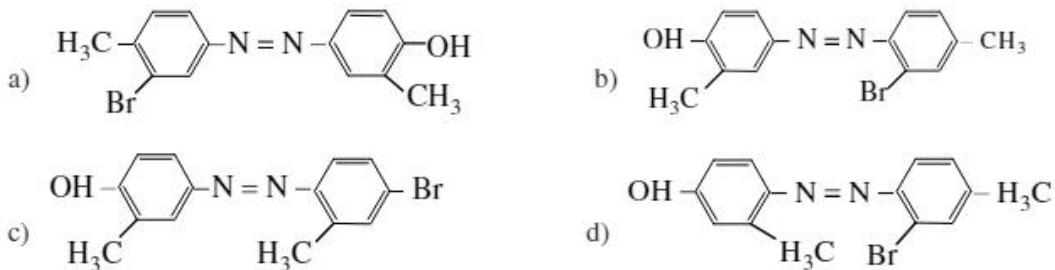
2. Consider the reactions

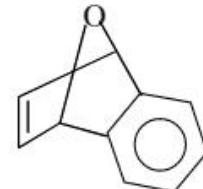
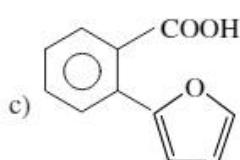
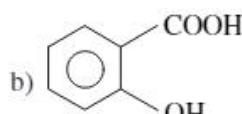
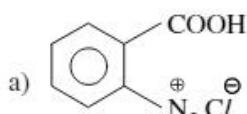
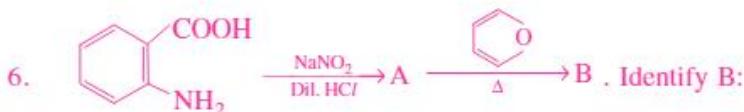
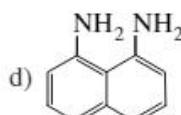
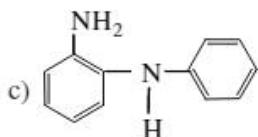
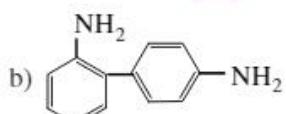
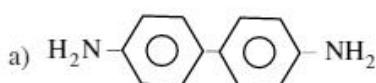
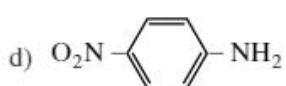
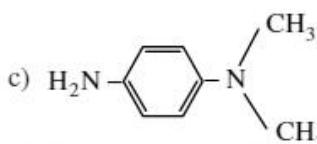
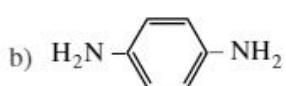
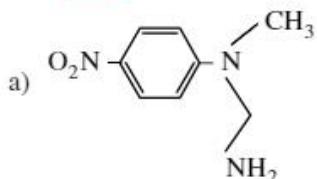
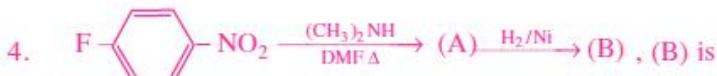


The products A,B,C respectively are



3.  The structure of the product B is





More than One correct answer Type Questions

7. Which of the following intermediates is Sandmeyer's reaction?

- a) $C_6H_5 - \overset{\oplus}{N} \equiv N^-$ b) $\cdot C_6H_5$ (Phenyl radical) c) C_6H_5Cl d) $C_6H_5N^+ = NCl^-$

8. Conversion of benzene diazonium chloride to chloro benzene is an example of which of the following reaction?

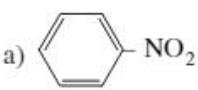
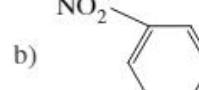
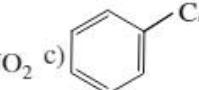
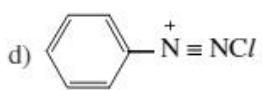
- a) Claisen b) Friedel-craft c) Sandmeyer d) Wurtz.

9. Which of the following can be used for nitration of aromatic compound?

- a) Conc. $HNO_3 +$ Conc. H_2SO_4 b) Nitronium tetrafluoroborate
c) Nitronium perchlorate d) $NaNO_2 + HCl$

10. Carbylamine test is used for the detection of primary amine group, which of these is related with carbylamine reaction?

- a) $R - NC$ b) $CHCl_3$ c) $NaNO_2 + HCl$ d) CCl_2

11. The compounds which can be purified by steam distillation.
- Nitrobenzene
 - Aniline
 - o*-nitro-phenol
 - m*-nitrophenol
12. Which of the following is/are correct?
- During mono nitration of benzene with conc. H_2SO_4 and conc. HNO_3 temperature should not be allowed to exceed $60^\circ C$
 - In nitrating mixture ($HNO_3 + H_2SO_4$) ; HNO_3 acts as base
 - Electrophilic substitution in aromatic compounds involves arenium ion
 - Nitrogen and H_2SO_4 can be used as nitrating mixture .
13. Which of the following undergo nucleophilic aromatic substitution?
- a)  b)  c)  d) 
14. A positive carbylamine test is given by
- N,N*-dimethylaniline
 - 2,4-dimethylaniline
 - N*-methyl-*o*-methylaniline
 - p*-methylbenzylamine
15. Which of the following is not be prepared by Sandmeyer's reaction?
- Chlorobenzene
 - Bromobenzene
 - Iodobenzene
 - Fluorobenzene

Linked Comprehension Type Questions

Passage-I :

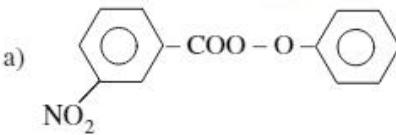
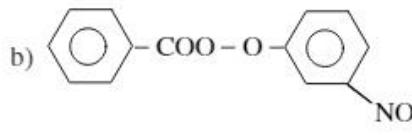
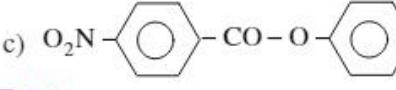
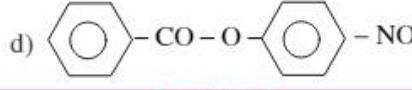
Reaction of benzene with a mixture of conc. HNO_3 and conc. H_2SO_4 at about $60^\circ C$ give nitrobenzene.

Nitration of substituted benzenes depends on the nature of the group already present in the ring.

Increase of temperature may result in multiple nitration.

16. Which of the following compounds undergo nitration at a rate faster than the other
- Toluene
 - Phenol
 - Benzene
 - Chlorobenzene
17. Nitration of benzene is an
- Electrophilic addition
 - Electrophilic substitution
 - Nucleophilic substitution
 - Nucleophilic addition

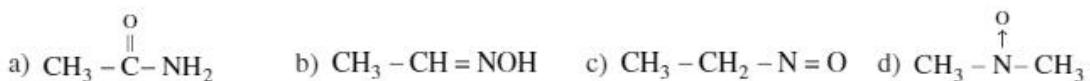


- a)  b) 
- c)  d) 

Passage-II :

'A' and 'B' are two isomeric compounds of the formula C_2H_5NO . 'A' on treatment with P_2PO_5 gives 'C'. Both 'A' and 'C' on alkaline hydrolysis evolve NH_3 . 'B' can be easily prepared from acetaldehyde. 'A' is amphoteric in nature and acid derivative.

19. The structure of 'A' is



20. 'B' is



21. 'C' is

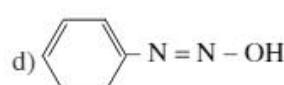
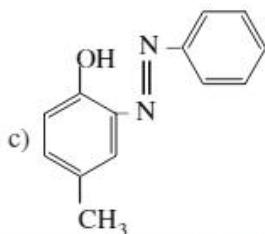
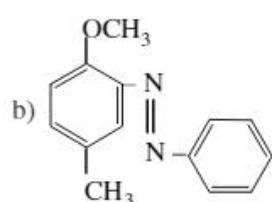
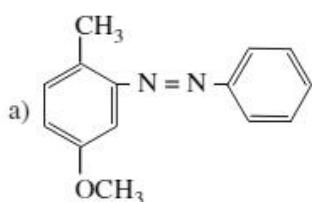
Passage-III :

A reaction of aryl diazonium salts that does not involve loss of nitrogen takes place when they react with phenol and aromatic amines. Aryl diazonium ion relatively is weak electrophile but has sufficient reactivity to attack strongly activated aromatic ring. the reaction is known as azo coupling. The coupling of diazonium ions with phenols or other electron rich aromatic compounds is useful commercial reaction as azo compounds are highly coloured and many of them are used as dyes.

22. Which of the following is responsible for the colour of diazo compounds?



23. Coupling between arendiazonium cation and amines takes place most rapidly at pH.

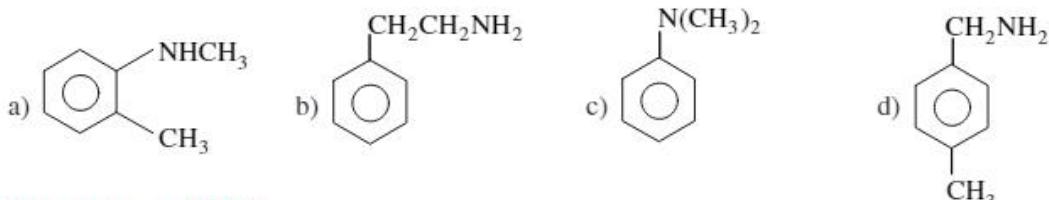


Passage-IV :

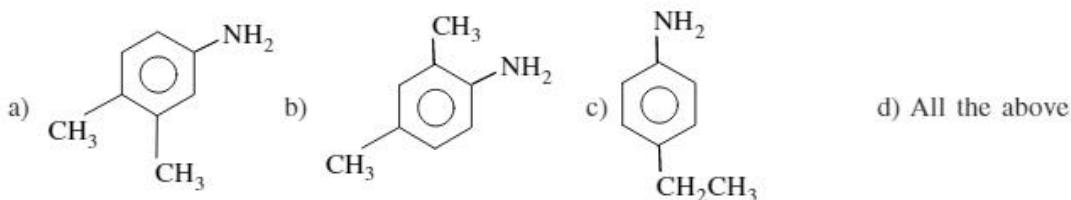
Several isomeric amines are possible with the molecular formula $C_8H_{11}N$. On the basis of the reaction given by each of the isomers, identify the structure of the compound.

- a) $A(C_8H_{11}N) \xrightarrow[0-5^{\circ}C]{NaNO_2-HCl}$ *p-Nitroso compound*
 b) $B(C_8H_{11}N) \xrightarrow[0-5^{\circ}C]{NaNO_2-HCl}$ *Diazonium salt formed*
 c) $C(C_8H_{11}N) \xrightarrow[0-5^{\circ}C]{NaNO_2-HCl}$ *N-Nitroso compound formed*

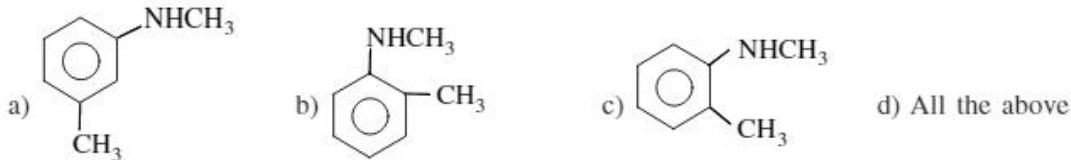
25. The structure of 'A' is likely to be



26. The structure of 'B' is



27. The structure of 'C' is

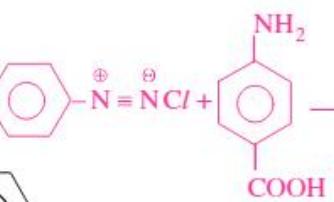
Passage-V :

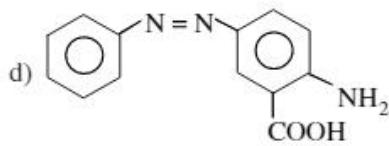
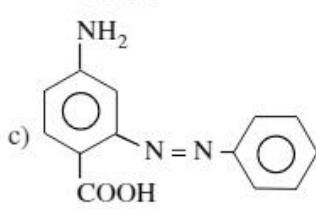
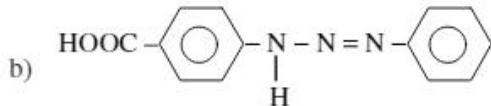
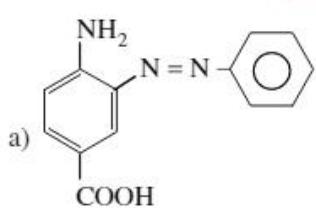
When an primary aromatic amine is treated with $NaNO_2 + HCl$ at $0^{\circ} - 5^{\circ}C$ a diazonium salt is formed and the reaction is called diazo reaction. In this reaction mineral acid must be added to prevent the coupling reaction of diazonium salt with excess of aryl amine. Diazonium salt is highly useful in the synthesis of number of coloured dyes.

28. For the following diazonium ion the decreasing order of reactivity of these ion in azo-coupling reaction.

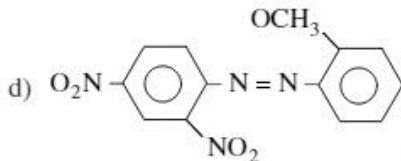
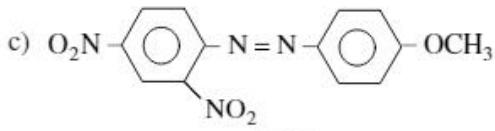
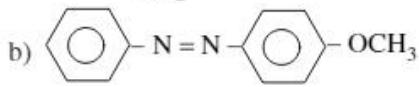
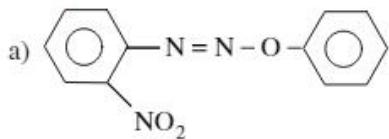


- a) Q > S > R > P b) Q > S > P > R c) P > Q > R > S d) S > R > Q > P

29. In the given reaction 



30. When 2,4-dinitrophenol react with $\text{NaNO}_2 + \text{HCl}$ at 5°C followed by reaction with anisole, a coloured compound is formed which can be given as



Integer Type Questions

31. The number of electrons change during the conversion of nitrobenzene to aniline is
32. Reduction of nitrobenzene with LiAlH_4 gives azobenzene. The number of hydrogen atoms involved in the formation of the product is
33. The number of resonance structures of nitrobenzene is
34. How many of the following give yellow oily liquid with
 $\text{NaNO}_2 + \text{HCl}, \text{CH}_3\text{CH}_2\text{NH}_2, \text{CH}_3\text{NHCH}_3, \text{CH}_3\text{CH}_2\text{NHCH}_3, \text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3,$
 $\text{CH}_3 - \underset{\text{CH}_3}{\text{N}} - \text{CH}_3, \text{C}_6\text{H}_5 - \underset{\text{CH}_3}{\text{N}} - \text{CH}_3, \text{C}_3\text{H}_7\text{NHCH}_3.$
35. $\text{CH}_3 - \text{C} \equiv \text{N} \xrightarrow[\text{CH}_3\text{MgCl}/\text{H}_3\text{O}^+]{\text{excess}} x.$ No of πe^- 's in the product

KEY SHEET (PRACTICE SHEET)

EXERCISE-I

LEVEL-I

- 1) 3 2) 4 3) 3 4) 4 5) 4 6) 3 7) 4 8) 4
 9) 1 10) 1 11) 3 12) 9, 4 13) 3

LEVEL-II

- 1) a 2) d 3) b 4) d 5) c 6) c 7) c 8) c
 9) 8 10) 3 11) 4 12) 4

EXERCISE-II

LEVEL-I

- 1) 3 2) 3 3) 4 4) 1 5) 1

LEVEL-II

- 1) c 2) b 3) d 4) d 5) b 6) c 7) b 8) c
 9) c 10) a

EXERCISE-III

LEVEL-I

- 1) 2 2) 3 3) 3 4) 1 5) 4 6) 1 7) 2 8) 3
 9) 3 10) 2 11) 2 12) 3

LEVEL-II

- 1) b 2) a 3) d 4) a 5) b 6) d 7) d 8) a
 9) d 10) a

EXERCISE-IV

LEVEL-I

- 1) 3 2) 4 3) 2 4) 2 5) 2 6) 3 7) 3 8) 4
 9) 1 10) 2 11) 3 12) 4 13) 3 14) 4 15) 2 16) 4
 17) 1 18) 3 19) 3 20) 3 21) 1 22) 1

LEVEL-II

- 1) a 2) a 3) c 4) b 5) b 6) b 7) a 8) b
 9) c 10) d 11) d 12) c 13) c 14) abd 15) acd 16) d
 17) acd 18) A-pr; B-q; C-r; D-s

EXERCISE-V

LEVEL-I

- 1) 4 2) 1 3) 4 4) 2 5) 2 6) 4 7) 2 8) 1
 9) 3 10) 8 11) 5 12) 3

LEVEL-II

- 1) c 2) b 3) b 4) c 5) ab 6) d 7) abcd 8) c
 9) abc 10) abd 11) abc 12) abc 13) abcd 14) bd 15) cd
 16) b 17) b 18) d 19) a 20) a 21) a 22) b 23) c
 24) b 25) c 26) d 27) d 28) b 29) a 30) c 31) 6
 32) 8 33) 5 34) 4 35) 2

ADDITIONAL PRACTICE EXERCISE

LEVEL-I (MAIN)

Straight Objective Type Questions

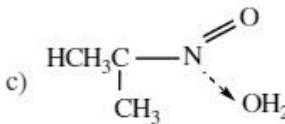
- A colourless, odourless and non-combustible gas liberated when ethylamine reacts with
 1) NaOH 2) CH_3COCl 3) $\text{NaNO}_2 + \text{HCl}$ 4) H_2SO_4
- Which one of the following amines will not liberate nitrogen on reaction with nitrous acid?
 1) CH_3NH_2 2) $\text{CH}_3\text{CH}_2\text{NH}_2$ 3) $(\text{CH}_3)_2\text{CNH}_2$ 4) $(\text{CH}_3)_3\text{N}$
- When amine is heated with chloroform and alcohol KOH, a bad odour compound is formed. The compound is
 1) an alcohol 2) an aldehyde 3) a cyanide 4) an isocyanide
- When methyl cyanide is hydrolysed in presence of alkali, it forms:
 1) acetamide 2) methane 3) $\text{CO}_2 + \text{H}_2$ 4) acetic acid
- $\text{CH}_3\text{NH}_2 + \text{CHCl}_3 + 3\text{KOH} \rightarrow \text{x} + \text{y} + 3\text{H}_2\text{O}$ compounds X and Y are
 1) $\text{CH}_3\text{CN} + 3\text{KCl}$ 2) $\text{CH}_3\text{NC} + 3\text{KCl}$ 3) $\text{CH}_3\text{CONH}_2 + 3\text{KCl}$ 4) $\text{CH}_3\text{NC} + \text{K}_2\text{CO}_3$
- In the following series of reactions, (A) is (A) $\xrightarrow{\text{Reduction}} \text{(B)} \xrightarrow{\text{HNO}_2} \text{C}_2\text{H}_5\text{OH}$
 1) CH_3CN 2) CH_3NC 3) $\text{C}_2\text{H}_5\text{CN}$ 4) CH_3NO_2
- The compound obtained by heating a mixture of primary amine and chloroform with alcoholic potassium hydroxide is
 1) an alkyl cyanide 2) a nitro compound
 3) an alkyl isocyanide 4) an amide
- $\text{CH}_3\text{CH}_2\text{Cl} \xrightarrow{\text{NaCN}} \text{(X)} \xrightarrow{\text{Ni/H}_2} \text{(Y)} \xrightarrow{\text{Acetic anhydride}} \text{(Z)}$ (Z) in the above reaction sequence is
 1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NHCOCH}_3$ 2) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$
 3) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CONHCH}_3$ 4) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CONHCOCOCH}_3$
- Ethyl isocyanide on hydrolysis in acidic medium gives
 1) ethanoic acid and ammonium salt 2) propanoic acid and ammonium salt
 3) ethylamine salt and methanoic acid 4) methylamine salt and ethanoic acid
- In the reaction $\text{CH}_3\text{CN} + 2\text{H} \xrightarrow[\text{Ether}]{\text{HCl}} \text{(X)} \xrightarrow{\text{Boiling H}_2\text{O}} \text{(Y)}$; the term of Y is
 1) acetaldehyde 2) ethylamine 3) acetone 4) dimethylamine

LEVEL-II

LECTURE SHEET (ADVANCED)

Straight Objective Type Questions

- $\text{C}_6\text{H}_5\text{C}\equiv\text{N} + 2[\text{H}] \xrightarrow{\text{SnCl}_2/\text{HCl}} \text{C}_6\text{H}_5\text{CHO} + \text{NH}_3$ The above reaction is
 a) Mendius reaction b) Schmidt reaction
 c) Rosemund reaction d) Stephen's reaction

2. Acetonitrile on reduction gives
 a) propanamine b) methanamine c) ethanamine d) None of these
3. An isonitrile on reduction gives
 a) 3^0 amine b) 2^0 amine
 c) 1^0 amine d) quaternary ammonium salts
4. Which of the following chemicals are used to manufacture methyl isocyanide that caused "Bhopal tragedy"?
 a) Methylamine b) Phosgene c) Phosphine d) Dimethylamine
5. Nitroethane on reaction with zinc dust and ammonium chloride gives
 a) ethanamine b) N-ethyl hydroxyl amine
 c) ethyl nitrite d) nitroso ethane
6. Hydrolysis of $\text{CH}_3\text{CH}_2\text{NO}_2$ with 85% H_2SO_4 gives
 a) $\text{CH}_3\text{CH}_2\text{OH}$ b) C_2H_6 c) $\text{CH}_3\text{CH} = \text{NOH}$ d) CH_3COOH
7. 2-Nitropropane on hydrolysis with boiling concentrated solution of HCl gives
 a) propane b) propanal c) propanone d) propanoic acid
8. Primary nitro compounds react with nitrous acid to form nitrolic acids which dissolve in sodium hydroxide to give
 a) yellow solution b) blue solution c) colourless solution d) red solution
9. The different behaviour of nitrous acid with 1^0 , 2^0 and 3^0 nitroalkanes forms the bases of
 a) Victor Meyer's test b) Lucas test
 c) Baker-Mulliken's test d) Nef-Carbonyl synthesis
10. Which of the following isomerism is exhibited in nitroethane?
 a) Geometrical isomerism b) Optical isomerism
 c) Functional isomerism d) Space isomerism
11. Which of the following is not a product?
 a) $\text{C}_6\text{N}_5\text{NO}_2$ b) $\text{CH}_3\text{CH}_2\text{ONO}$ c)  d) $\text{C}_6\text{H}_4(\text{OH})\text{NO}_2$

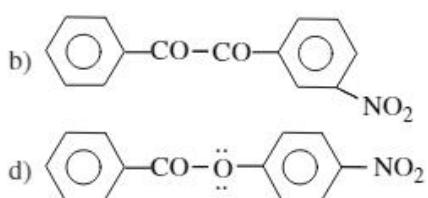
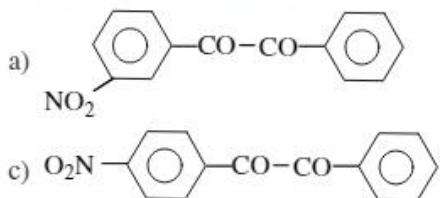
Linked Comprehension Type Questions

Passage :

Reaction of benzene with a mixture of conc. HNO_3 and Conc. H_2SO_4 at about 60°C give nitrobenzene.
 Nitration of substituted benzenes depends on the nature of the group already present in the ring.
 Increase of temperature may result in multiple nitration.

12. Which of the following compounds undergo nitration at a rate faster than the other than
 a) Toluene b) Phenol c) Benzene d) Chlorobenzene
13. Nitration of benzene is an
 a) Electrophilic addition b) Electrophilic substitution
 c) Nucleophilic substitution d) Nucleophilic addition

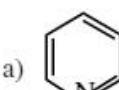
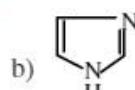
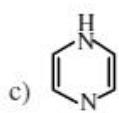
14.  $\xrightarrow{\text{Nitration}}$ product is

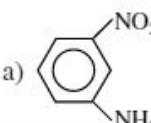
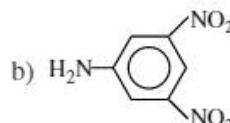
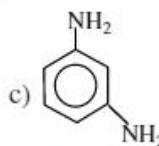
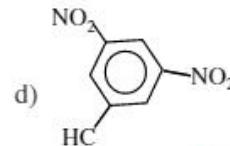


PRACTICE SHEET (ADVANCED)

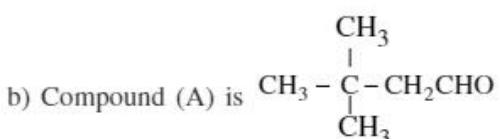
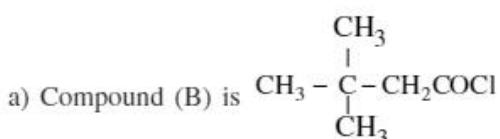
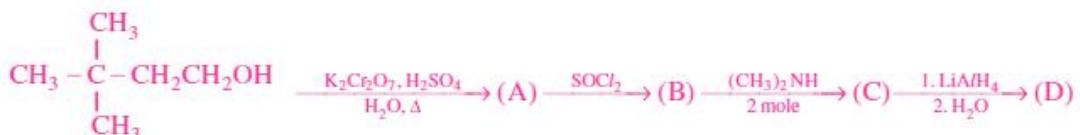
Straight Objective Type Questions

1. Which of the following statements is correct
 - a) Butan-1-ol is more soluble in water
 - b) $(CH_3)_3N$ is more soluble in water than $CH_3CH_2CH_2NH_2$
 - c) $(CH_3)_3N$ and $CH_3CH_2NHCH_3$ cannot form hydrogen bond with water
 - d) Both a & c
2. Which of the following statements concerning amine oxides is not true?
 - a) Chiral amine oxides may be resolved.
 - b) The nitrogen has a positive formal charge.
 - c) The nitrogen hybridization is sp^3 .
 - d) All types of amines can form amine oxide derivatives.
3. Which of the following is aromatic

a) 
b) 
c) 
d) Both a & b
4. In which reaction is a quaternary ammonium salt is not formed?
 - a) Reaction of $EtNH_2$ with excess MeI .
 - b) Reaction of $EtNH_2$ with $EtCl$.
 - c) Reaction of $EtNH_2$ with $n\text{-BuBr}$
 - d) Reaction of $EtNH_2$ with $MeCOCl$.
5. Which statement is incorrect about the reaction of $EtCOCl$ (an acyl chloride) with $EtNH_2$?
 - a) The product is an amide which can be reduced to a tertiary amine
 - b) The product is $EtCONHET$
 - c) HCl is eliminated
 - d) It is a nucleophilic displacement reaction.
6. Reaction of m-dinitro benzene with $(NH_4)_2S_X$ gives

a) 
b) 
c) 
d) 

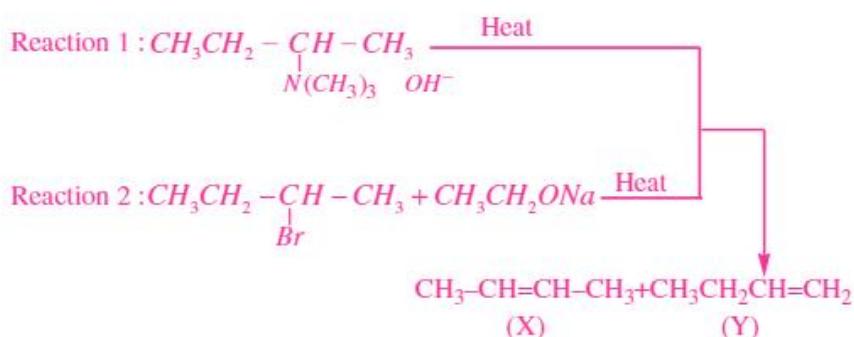
7. In the given reaction sequence,



c) Compound (C) is

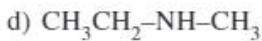
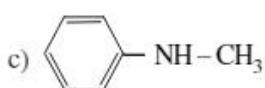
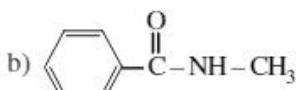
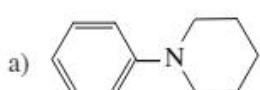
d) Compound (D) is

8. In the given reactions, Reaction 1 :

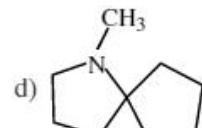
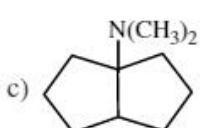
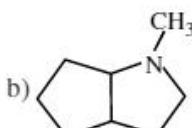
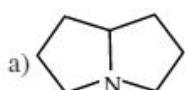


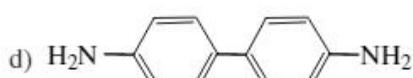
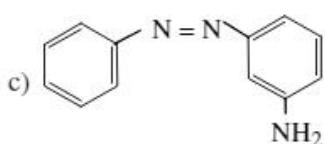
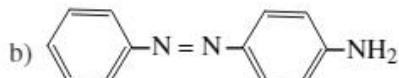
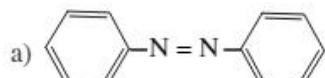
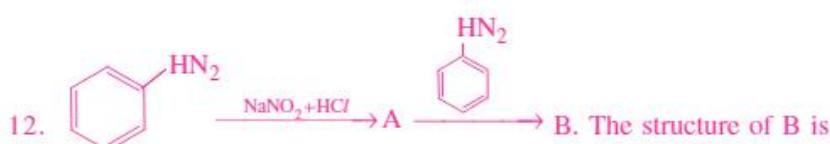
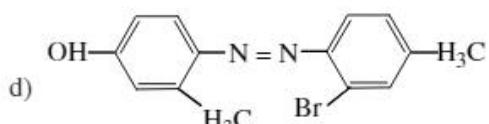
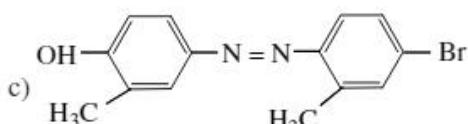
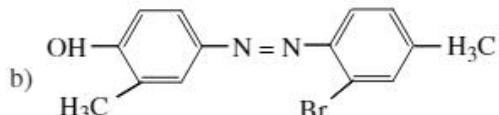
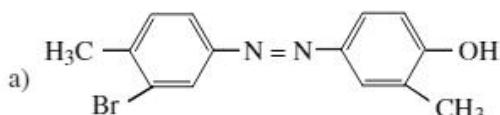
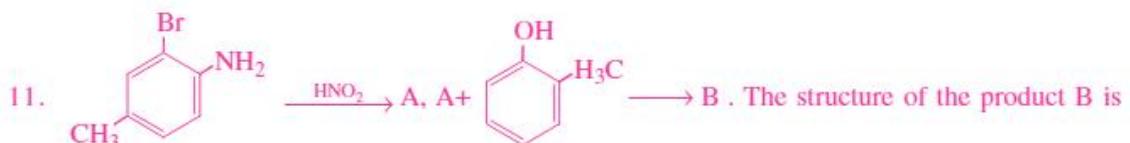
- a) The major product in reacton 1 is (X)
- b) The major product in reacton 1 is (Y)
- c) The major product in reacton 2 is (X)
- d) The major product in reacton 2 is (Y)

9. Which compound yields an N-nitroso amino after treatment with nitrous acid ($\text{NaNO}_2 + \text{HCl}$)?

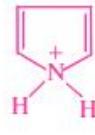
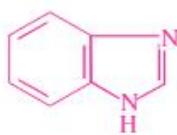
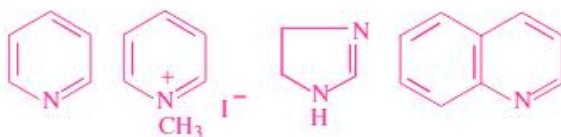


10. The nitrogen atom in each of the following tertiary amines may be removed as trimethyl amine by repeated Hofmann eliminations (exhaustive methylation followed by heating with AgOH). Which of the amines requires the greater number of Hofmann sequences to accomplish this?





13. Which of the following nitrogen containing compounds are aromatic according to Huckel rule identify the total number?



a) 2

b) 3

c) 5

d) 4

Matrix Matching Type Questions

14. Column-I

- A) Pyridine
- B) Quinoline
- C) Pyrimidine
- D) Pyrrole

Column-II

- p) $pK_a = 2.70$
- q) $pK_a = 5.23$
- r) $pK_a = 0.40$
- s) $pK_a = 4.5$

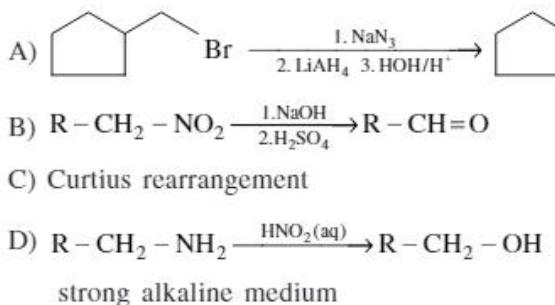
15. Column - I

- A) Hofmann degradation
 B) Curtius rearrangement
 C) Lossen rearrangement
 D) Hemiaminal

Column - II

- p) Aldehyde + 1^o amine
 q) Isocynate
 r) Br₂ + NaOH
 s) $\text{R}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{N}_3$

16. Column - I



Column - II

KEY SHEET (ADDITIONAL PRACTICE EXERCISE)

LEVEL-I (MAIN)

- 1) c 2) d 3) d 4) d 5) b 6) a 7) c 8) a 9) c 10) a

LEVEL-II

LECTURE SHEET (ADVANCED)

- 1) d 2) c 3) b 4) a 5) b 6) d 7) c 8) d 9) a 10) c
 11) b 12) b 13) b 14) d

PRACTICE SHEET (ADVANCED)

- 1) d 2) d 3) d 4) d 5) a 6) a 7) a 8) c 9) cd 10) a
 11) b 12) b 13) d 14) A-q; B-s; C-p; D-r 15) A-r; B-s; C-p; D-pq
 16) A-r; B-p; C-s; D-q

