

### I. Multiple Choice Questions (Type-I)

1. Which of the following is a 3° amine?

- (i) 1-methylcyclohexylamine
- (ii) Triethylamine
- (iii) tert-butylamine
- (iv) N-methyl aniline

**Solution:**

Option (ii) is the answer.

2. The correct IUPAC name for  $\text{CH}_2=\text{CHCH}_2\text{NHCH}_3$  is

- (i) Allylmethylamine
- (ii) 2-amino-4-pentene
- (iii) 4-aminopent-1-ene
- (iv) N-methylprop-2-en-1-amine

**Solution:**

Option (iv) is the answer.

3. Amongst the following, the strongest base in aqueous medium is \_\_\_\_\_.

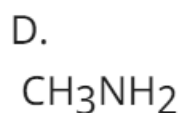
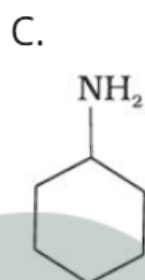
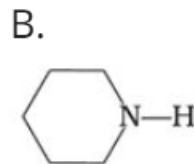
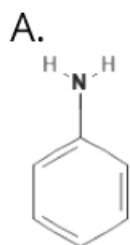
- (i)  $\text{CH}_3\text{NH}_2$
- (ii)  $\text{NCCH}_2\text{NH}_2$
- (iii)  $(\text{CH}_3)_2\text{NH}$
- (iv)  $\text{C}_6\text{H}_5\text{NHCH}_3$

**Solution:**

Option (iii) is the answer.

4. Which of the following is the weakest Brønsted base?

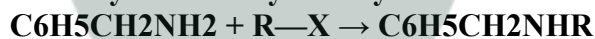




**Solution:**

Option (A) is the answer.

5. Benzylamine may be alkylated as shown in the following equation :



Which of the following alkyl halides is best suited for this reaction through  $\text{S}_\text{N}1$  mechanism?

- (i)  $\text{CH}_3\text{Br}$
- (ii)  $\text{C}_6\text{H}_5\text{Br}$
- (iii)  $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$
- (iv)  $\text{C}_2\text{H}_5\text{Br}$

**Solution:**

Option (iii) is the answer.

6. Which of the following reagents would not be a good choice for reducing an aryl nitro compound to an amine?

- (i)  $\text{H}_2$  (excess)/Pt
- (ii)  $\text{LiAlH}_4$  in ether
- (iii) Fe and HCl
- (iv) Sn and HCl

**Solution:**

Option (ii) is the answer.

7. To prepare a  $1^\circ$  amine from an alkyl halide with simultaneous addition

of one CH<sub>2</sub> group in the carbon chain, the reagent used as a source of nitrogen is \_\_\_\_\_.

- (i) Sodium amide, NaNH<sub>2</sub>
- (ii) Sodium azide, NaN<sub>3</sub>
- (iii) Potassium cyanide, KCN
- (iv) Potassium phthalimide, C<sub>6</sub>H<sub>4</sub>(CO)<sub>2</sub>N-K<sup>+</sup>

**Solution:**

Option (iii) is the answer.

8. The source of nitrogen in Gabriel synthesis of amines is \_\_\_\_\_.

- (i) Sodium azide, NaN<sub>3</sub>
- (ii) Sodium nitrite, NaNO<sub>2</sub>
- (iii) Potassium cyanide, KCN
- (iv) Potassium phthalimide, C<sub>6</sub>H<sub>4</sub>(CO)<sub>2</sub>N-K<sup>+</sup>

**Solution:**

Option (iv) is the answer.

9. Amongst the given set of reactants, the most appropriate for preparing 2° amine is \_\_\_\_\_.

- (i) 2° R-Br + NH<sub>3</sub>
- (ii) 2° R-Br + NaCN followed by H<sub>2</sub>/Pt
- (iii) 1° R-NH<sub>2</sub> + RCHO followed by H<sub>2</sub>/Pt
- (iv) 1° R-Br (2 mol) + potassium phthalimide followed by H<sub>3</sub>O<sup>+</sup>/heat

**Solution:**

Option (iii) is the answer.

10. The best reagent for converting 2-phenylpropanamide into 2-phenylpropanolamine is \_\_\_\_\_.

- (i) excess H<sub>2</sub>
- (ii) Br<sub>2</sub> in aqueous NaOH
- (iii) iodine in the presence of red phosphorus
- (iv) LiAlH<sub>4</sub> in ether

**Solution:**

Option (iv) is the answer.

11. The best reagent for converting, 2-phenylpropanamide into 1-phenylethanamine is \_\_\_\_\_.

- (i) excess H<sub>2</sub>/Pt
- (ii) NaOH/Br<sub>2</sub>
- (iii) NaBH<sub>4</sub>/methanol
- (iv) LiAlH<sub>4</sub>/ether

**Solution:**

Option (ii) is the answer.

12. Hoffmann Bromamide Degradation reaction is shown by \_\_\_\_\_.

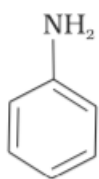
- (i) ArNH<sub>2</sub>

- (ii) ArCONH<sub>2</sub>  
 (iii) ArNO<sub>2</sub>  
 (iv) ArCH<sub>2</sub>NH<sub>2</sub>

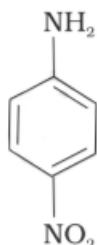
**Solution:**

Option (ii) is the answer.

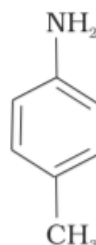
13. The correct increasing order of basic strength for the following compounds is \_\_\_\_\_.



(I)



(II)



(III)

- (i) II < III < I  
 (ii) III < I < II  
 (iii) III < II < I  
 (iv) II < I < III

**Solution:**

Option (iv) is the answer.

14. Methylamine reacts with HNO<sub>2</sub> to form \_\_\_\_\_.

- (i) CH<sub>3</sub>—O—N=O  
 (ii) CH<sub>3</sub>—O—CH<sub>3</sub>  
 (iii) CH<sub>3</sub>OH  
 (iv) CH<sub>3</sub>CHO

**Solution:**

Option (iii) is the answer.

15. The gas evolved when methylamine reacts with nitrous acid is \_\_\_\_\_.

- (i) NH<sub>3</sub>  
 (ii) N<sub>2</sub>  
 (iii) H<sub>2</sub>  
 (iv) C<sub>2</sub>H<sub>6</sub>

**Solution:**

Option (ii) is the answer.

16. In the nitration of benzene using a mixture of conc.  $\text{H}_2\text{SO}_4$  and conc.  $\text{HNO}_3$ , the species which initiates the reaction is \_\_\_\_\_.

- (i)  $\text{NO}_2$
- (ii)  $\text{NO}^+$
- (iii)  $\text{NO}_2^+$
- (iv)  $\text{NO}_2^-$

**Solution:**

Option (iii) is the answer.

17. Reduction of aromatic nitro compounds using Fe and HCl gives \_\_\_\_\_.

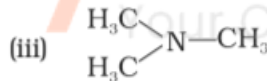
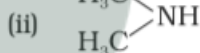
- (i) aromatic oxime
- (ii) aromatic hydrocarbon
- (iii) aromatic primary amine
- (iv) aromatic amide

**Solution:**

Option (iii) is the answer.

18. The most reactive amine towards dilute hydrochloric acid is \_\_\_\_\_.

**Solution:**



(iv)



**Solution:**

Option (ii) is the answer.

19. Acid anhydrides on reaction with primary amines give \_\_\_\_\_.

- (i) amide
- (ii) imide
- (iii) secondary amine
- (iv) imine

**Solution:**

Option (i) is the answer

20. The reaction  $\text{Ar—N}_2\text{Cl} \xrightarrow{\text{Cu/HCl}} \text{ArCl} + \text{N}_2 + \text{CuCl}$  is named as \_\_\_\_\_.

- (i) Sandmeyer reaction
- (ii) Gatterman reaction
- (iii) Claisen reaction
- (iv) Carbylamine reaction

**Solution:**

Option (ii) is the answer.

**21. The best method for preparing primary amines from alkyl halides without changing the number of carbon atoms in the chain is**

- (i) Hoffmann Bromamide reaction
- (ii) Gabriel phthalimide synthesis
- (iii) Sandmeyer reaction
- (iv) Reaction with  $\text{NH}_3$

**Solution:**

Option (ii) is the answer.

**22. Which of the following compound will not undergo an azo coupling reaction with benzene diazonium chloride.**

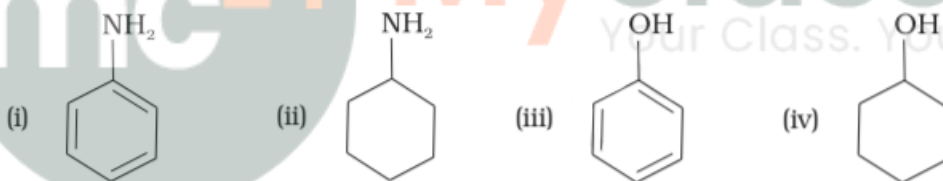
- (i) Aniline
- (ii) Phenol
- (iii) Anisole
- (iv) Nitrobenzene

**Solution:**

Option (iv) is the answer.

**23. Which of the following compounds is the weakest Brönsted base?**

**Solution:**



**Solution:**

Option (iii) is the answer.

**24. Among the following amines, the strongest Brönsted base is \_\_\_\_\_.**



**Solution;**

Option (iv) is the answer.

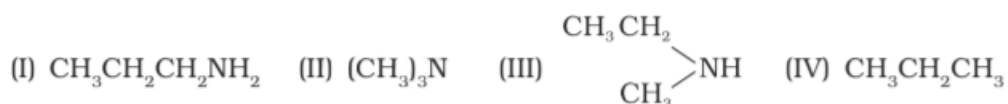
25. The correct decreasing order of basic strength of the following species is \_\_\_\_\_.  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{OH}^-$ ,  $\text{NH}_2^-$

- (i)  $\text{NH}_2^- > \text{OH}^- > \text{NH}_3 > \text{H}_2\text{O}$   
 (ii)  $\text{OH}^- > \text{NH}_2^- > \text{H}_2\text{O} > \text{NH}_3$   
 (iii)  $\text{NH}_3 > \text{H}_2\text{O} > \text{NH}_2^- > \text{OH}^-$   
 (iv)  $\text{H}_2\text{O} > \text{NH}_3 > \text{OH}^- > \text{NH}_2^-$

**Solution:**

Option (i) is the answer.

26. Which of the following should be most volatile?



- (i) II  
 (ii) IV  
 (iii) I  
 (iv) III

**Solution:**

Option (ii) is the answer.

27. Which of the following methods of preparation of amines will give the same number of carbon atoms in the chain of amines as in the reactant?

- (i) The reaction of nitrite with  $\text{LiAlH}_4$ .  
 (ii) The reaction of the amide with  $\text{LiAlH}_4$  followed by treatment with water.  
 (iii) Heating alkyl halide with potassium salt of phthalimide followed by hydrolysis.  
 (iv) Treatment of amide with bromine in the aqueous solution of sodium hydroxide.

**Solution:**

Option (iii) is the answer.

## II. Multiple Choice Questions (Type-II)

**Note:** In the following questions two or more options may be correct.

28. Which of the following cannot be prepared by Sandmeyer's reaction?

- (i) Chlorobenzene  
 (ii) Bromobenzene  
 (iii) Iodobenzene

(iv) Fluorobenzene

**Solution:**

Option (iii) and (iv) are the answers.

**29. Reduction of nitrobenzene by which of the following reagent gives aniline?**

(i) Sn/HCl

(ii) Fe/HCl

(iii) H<sub>2</sub>-Pd

(iv) Sn/NH<sub>4</sub>OH

**Solution;**

Option (i), (ii) and (iii) are the answers.

**30. Which of the following species are involved in the carbylamine test?**

(i) R—NC

(ii) CHCl<sub>3</sub>

(iii) COCl<sub>2</sub>

(iv) NaNO<sub>2</sub> + HCl

**Solution:**

Option (i) and (ii) are the answers.

**31. The reagents that can be used to convert benzene diazonium chloride to benzene are \_\_\_\_\_.**

(i) SnCl<sub>2</sub>/HCl

(ii) CH<sub>3</sub>CH<sub>2</sub>OH

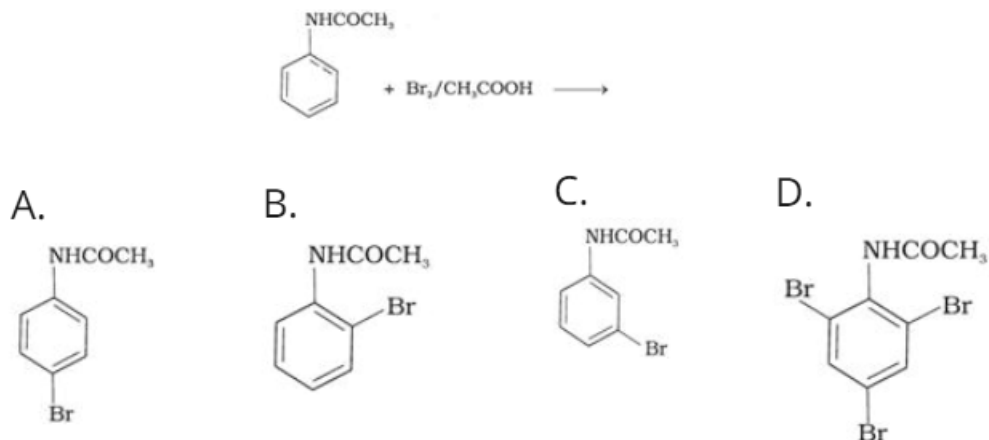
(iii) H<sub>3</sub>PO<sub>2</sub>

(iv) LiAlH<sub>4</sub>

**Solution:**

Option (ii) and (iii) are the answers.

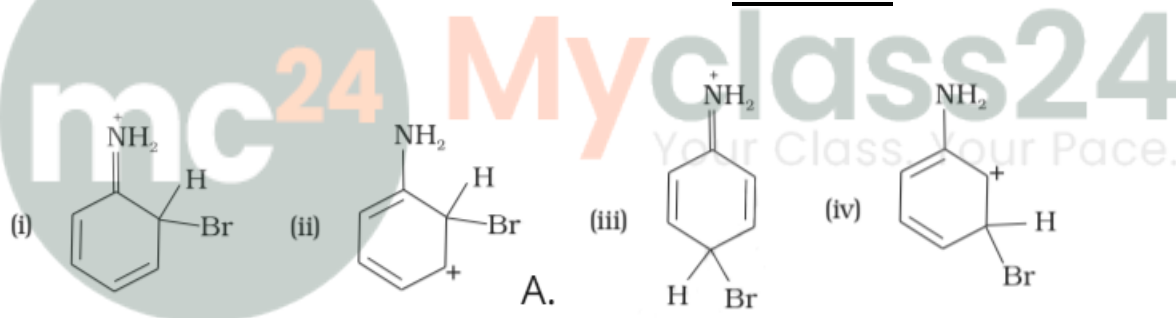
**32. The product of the following reaction is \_\_\_\_\_.**



**Solution:**

Option (A) and (B) is the answer.

33. Arenium ion involved in the bromination of aniline is \_\_\_\_\_.



**Solution:**

Option (i), (ii) and (iii) are the answers.

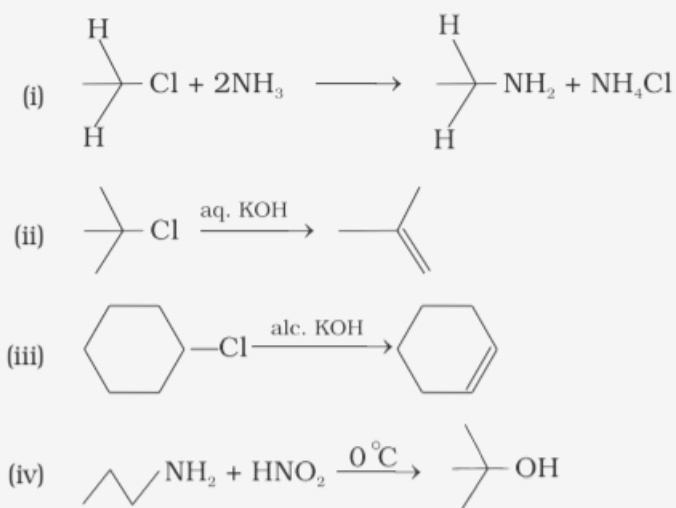
34. Which of the following amines can be prepared by Gabriel synthesis.

- (i) Isobutyl amine
- (ii) 2-Phenylethylamine
- (iii) N-methyl benzylamine
- (iv) Aniline

**Solution:**

Option (i) and (ii) are the answers.

35. Which of the following reactions are correct?



**Solution:**

Option (i) and (iii) are the answers.

**36. Under which of the following reaction conditions, aniline gives p-nitro derivative as the major product?**

(i) Acetyl chloride/pyridine followed by reaction with conc. H<sub>2</sub>SO<sub>4</sub> + conc. HNO<sub>3</sub>

(ii) Acetic anhydride/pyridine followed by conc. H<sub>2</sub>SO<sub>4</sub> + conc. HNO<sub>3</sub>

(iii) Dil. HCl followed by reaction with conc. H<sub>2</sub>SO<sub>4</sub> + conc. HNO<sub>3</sub>

(iv) Reaction with conc. HNO<sub>3</sub> + conc. H<sub>2</sub>SO<sub>4</sub>

**Solution:**

Option (i) and (ii) are the answers.

**37. Which of the following reactions belong to electrophilic aromatic substitution?**

(i) Bromination of acetanilide

(ii) Coupling reaction of aryldiazonium salts

(iii) Diazotisation of aniline

(iv) Acylation of aniline

**Solution:**

Option (i) and (ii) are the answers.

### III. Short Answer Type

**38. What is the role of HNO<sub>3</sub> in the nitrating mixture used for nitration of benzene?**

**Solution:**

Nitrating mixture is the mixture of 1:1 solution of HNO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub> and is used for the nitration of organic compounds. It acts as a base and provides electrophile in the nitration process of benzene.

**39. Why is NH<sub>2</sub> group of aniline acetylated before carrying out nitration?**

**Solution:**

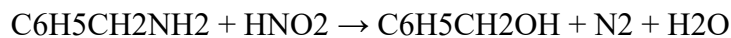
To control the nitration reaction and to avoid oxidation products and nitro derivatives products formation, the NH<sub>2</sub> group of aniline is acetylated before carrying out nitration. Here, the major product is p-

nitroaniline.

**40. What is the product when  $C_6H_5CH_2NH_2$  reacts with  $HNO_2$ ?**

**Solution:**

$C_6H_5CH_2NH_2$  reacts with  $HNO_2$  to form unstable diazonium salt, which in turn gives alcohol.

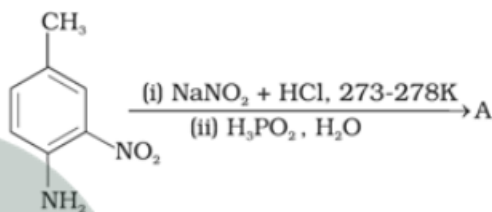


**41. What is the best reagent to convert nitrile to primary amine?**

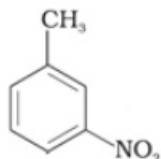
**Solution:**

The best reagents for the conversion of nitrile to primary amine are  $LiAlH_4$  and Sodium/Alcohol. By reduction, the nitriles can be converted into a corresponding primary amine.

**42. Give the structure of 'A' in the following reaction.**



**Solution:**



The product formed in this chemical reaction is 3-Methylnitrobenzene.

**43. What is Hinsberg reagent?**

**Solution:**

Benzenesulphonyl chloride or,  $C_6H_5SOCl$  is commonly known as Hinsberg's reagent. Hinsberg's reagent is used to distinguish primary, secondary and tertiary amines.

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

**Solution:**

Benzene diazonium chloride is highly soluble in water at high temperature and is itself very stable at low temperature. It should be used immediately after its preparation as it is unstable.

**45. Why does the acetylation of —NH<sub>2</sub> group of aniline reduce its activating effect?**

**Solution:**

The acetylation of —NH<sub>2</sub> group of aniline reduces its activating effect because the lone pair of electrons on the nitrogen of acetanilide interacts with oxygen atom due to resonance.

**46. Explain why MeNH<sub>2</sub> is a stronger base than MeOH?**

**Solution:**

MeNH<sub>2</sub> is a stronger base than MeOH because of the lower electronegativity and the presence of the lone pair of electrons on the nitrogen atom in MeNH<sub>2</sub>.

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

**Solution:**

The activating effect of —NH<sub>2</sub> group can be controlled by protecting the —NH<sub>2</sub> group by acetylation with acetic anhydride in presence of pyridine and then carrying out the desired substitution followed by hydrolysis of the substituted amide to the substituted amine. Pyridine is a base that is used to get rid of HCl as a side product from the reaction.

**48. Under what reaction conditions (acidic/basic), the coupling reaction of aryldiazonium chloride with aniline is carried out?**

**Solution:**

This reaction is carried out in a mild basic medium. This is an electrophilic substitution reaction. Aryldiazonium chloride reacts with aniline to form a yellow dye of p-Aminoazobenzene.

**49. Predict the product of the reaction of aniline with bromine in a non-polar solvent such as CS<sub>2</sub>.**

**Solution:**

The products formed in the reaction of aniline with bromine in a non-polar solvent such as CS<sub>2</sub> are 4-Bromoaniline and 2-Bromoaniline where 4-Bromoaniline is the major product.

**50. Arrange the following compounds in increasing order of dipole moment.**

**CH<sub>3</sub>CH<sub>2</sub>CH<sub>3</sub>, CH<sub>3</sub>CH<sub>2</sub>NH<sub>2</sub>, CH<sub>3</sub>CH<sub>2</sub>OH**

**Solution:**

**CH<sub>3</sub>CH<sub>2</sub>CH<sub>3</sub> < CH<sub>3</sub>CH<sub>2</sub>NH<sub>2</sub> < CH<sub>3</sub>CH<sub>2</sub>OH**

The dipole moment of CH<sub>3</sub>CH<sub>2</sub>OH is greater than that of CH<sub>3</sub>CH<sub>2</sub>NH<sub>2</sub>. CH<sub>3</sub>CH<sub>2</sub>CH<sub>3</sub> has the least dipole moment among the three given compounds because it is almost a non-polar molecule.