

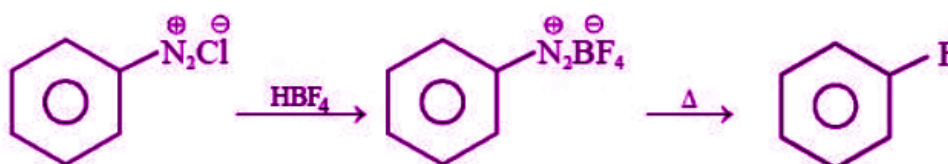
## Amines Chemistry Questions with Solutions

**Q1. Fluorination of an aromatic ring is easily accomplished by treating a diazonium salt with  $\text{HBF}_4$ . Which of the following conditions is correct about this reaction?**

- a.)  $\text{NaF}/\text{Cu}$
- b.)  $\text{Cu}_2\text{O} / \text{H}_2\text{O}$
- c.) Only heat
- d.)  $\text{NaNO}_2 / \text{Cu}$

**Correct Answer.** (c.) Only heat

**Explanation-**



**Q2. Which amino acid is present only in bacteria and cyanobacteria?**

- a.) Tyrosine
- b.) Glycine
- c.) Diaminopimelic acid
- d.) Glutamic acid

**Correct Answer.** (d.) Glutamic acid

**Q3. Which of the following will be most basic in nature?**

- a.) Aniline
- b.) p-methoxyaniline
- c.) p-nitroaniline
- d.) Benzylamine

**Correct Answer.** (d.) Benzylamine

**Explanation-** Aromatic amines are less basic than aliphatic amines.

**Q4. Which of the following compound will give secondary amine on the reduction?**

- a.) Alkyl nitrile
- b.) Carbylamine
- c.) Primary amine
- d.) Secondary nitro compound

**Correct Answer.** (b.) Carbylamine

**Q5. Benzylamine is a stronger base than \_\_\_.**

- a.) Aniline
- b.) Acetamide
- c.) o-methylaniline
- d.) All of the above

**Correct Answer-** (d.) All of the above

**Q6. State True or False.**

**$P_{k_b}$  of aniline is more than that of methylamine.**

**Answer.** True.

Since the  $NH_2$  group is directly attached to the benzene ring in aniline and other arylamines. It causes the unshared electron pair on the nitrogen atom to be in conjugation with the benzene ring, making it less available for protonation, whereas there is no such conjugation in methylamine, making the lone pair of electrons more freely available for protonation.

**Q7. Arrange the following compounds in the increasing order of basic strengths in their aqueous solutions:  $NH_3$ ,  $CH_3NH_2$ ,  $(CH_3)_2NH$ ,  $(CH_3)_3N$**

**Answer.** Basicity order (due to stability of ammonium cation)

$(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$

**Q8. What is the IUPAC name of the compound:  $C_6H_5 - NH - C_6H_5$ ?**

**Answer.** The IUPAC name of the given compound is N, N-diphenylamine.

**Q9. Explain why an alkylamine is more basic than ammonia?**

**Answer.** The electron density on the nitrogen atom increases due to the electron releasing inductive effect (+I) of the alkyl group, and thus it can donate the lone pair of electrons more easily than ammonia.

**Q10. Give reasons :**

**(a) Aniline is a weaker base than cyclohexylamine.**

**(b) It is difficult to prepare pure amines by ammonolysis of alkyl halides.**

**Answer.**

(a) The lone pair of electrons on the N-atom in aniline are delocalised over the benzene ring. The electron density of the nitrogen decreases as a result.

However, because there are no -electrons in cyclohexylamine, the lone pair of electrons on the N-atom are readily available. As a result, aniline is a weaker base than cyclohexylamine.

(b) This is because the primary amine produced by ammonolysis acts as a nucleophile, producing additional 2° and 3° alkyl amine.

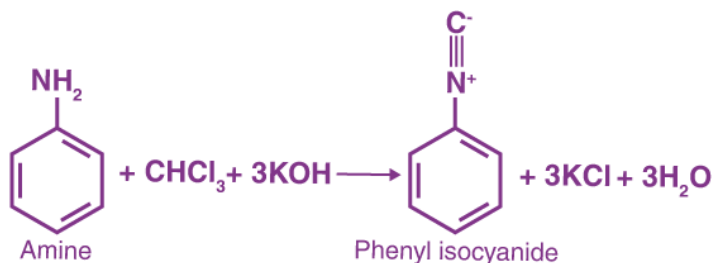
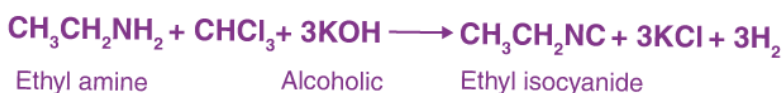
**Q11. Describe the following giving the relevant chemical equation in each case :**

**(i) Carbylamine reaction**

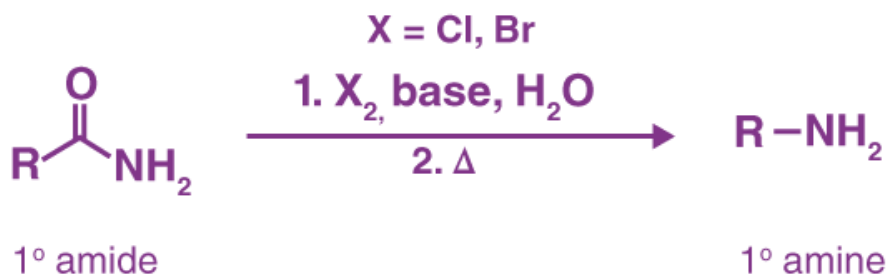
**(ii) Hofmann's bromamide reaction**

**Answer.**

(i) Carbylamine reaction - The carbylamine reaction (also known as the Hoffmann isocyanide synthesis) is the reaction of a primary amine, chloroform, and base to produce an isocyanide. Dichlorocarbene serves as an intermediary in the conversion. It's employed in the production of secondary amines.



(ii) Hofmann's bromamide reaction - Formation of amines from amide by the reaction of bromine and sodium hydroxide. The amine formed has 1 carbon less than the amide.



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**Q12. State reasons for the following :**

- (i)  $pK_b$  value for aniline is more than that for methylamine.
- (ii) Ethylamine is soluble in water whereas aniline is not soluble in water.
- (iii) Primary amines have higher boiling points than tertiary amines.

**Answer.**

- (i) This is because the lone pair of electrons on the nitrogen atom become delocalized over the benzene ring and are unavailable for protonation due to resonance in aniline, which is absent in alkylamine, aniline is less basic than methylamine.
- (ii) Ethylamine is soluble in water due to its ability to form H-bonds with water, whereas aniline is insoluble in water due to its larger hydrocarbon component, which tends to retard H-bond formation.
- (iii) Primary amines undergo extensive intermolecular H-bonding due to the presence of two H-atoms on the N-atom, whereas tertiary amines do not undergo H-bonding due to the absence of an H-atom on the N-atom. As a result, primary amines have greater boiling points than  $3^\circ$  amines.

**Q13. Give reasons for the following:**

- (i) Aniline does not undergo Friedel-Crafts reaction.
- (ii)  $(\text{CH}_3)_2\text{NH}$  is more basic than  $(\text{CH}_3)_3\text{N}$  in an aqueous solution.
- (iii) Primary amines have a higher boiling point than tertiary amines.

**Answer.**

- (i) Since aniline is a Lewis base, it reacts with the Lewis acid  $\text{AlCl}_3$  to form a salt. As a result, the N of aniline gains a positive charge, acting as a strong deactivating group for the electrophilic substitution reaction. As a result, aniline does not undergo the Friedel Crafts reaction.
- (ii) This is because of steric hindrance, the extent of hydration decreases as the number of methyl groups increases. The greater the extent of hydration, the greater the ion stability and the basic strength of amine.

(iii) Primary amines undergo extensive intermolecular H-bonding due to the presence of two H-atoms on the N-atom, whereas tertiary amines do not undergo H-bonding due to the absence of an H-atom on the N-atom. As a result, the boiling points of primary amines are higher than those of 3° amines.

**Q14. Explain why amines are more basic than amides?**

**Answer.** Amine is more basic than amides as there is an unshared electron pair on the localised nitrogen atom available for protonation. Whereas in amides, the electron pair is delocalised to the carbonyl group through resonance.

**Q15. Give the differences between an amine, amide and imine?**

**Answer.** Amines are NH<sub>3</sub> derivatives.

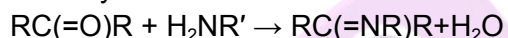
Amides are acid derivatives. Imines are carbonyl compound nitrogen derivatives. Imines and amines differ in that imines are nitrogen derivatives of carbonyl compounds, whereas amines are ammonia derivatives.

Organic amines, NR<sub>3</sub>, are ammonia NH<sub>3</sub> derivatives.

The term amide refers to the acid derivative RC(=O)NR<sub>2</sub>.

Ammonia conjugate bases, such as potassium amide, KNH<sub>2</sub>, which is unknown in aqueous solution but known in liquid ammonia. Normally, the context will determine which amide is intended, and in organic chemistry, the acid derivative (the former) is usually specified.

An imine, on the other hand, RC(=NR')R is a carbonyl derivative formed by the condensation of a carbonyl and an amine.



## Practise Questions on Amines

**Q1. Amines are the derivatives of:**

- a.) acids
- b.) ammonia
- c.) alkanes
- d.) esters

**Correct Answer.** (b.) ammonia

**Explanation-** Amines are ammonia derivatives in which one or more hydrogen atoms have been replaced by an alkyl or aryl group.

**Q2. The structural formula of methylamino methane is-**

- a.) (CH<sub>3</sub>)<sub>2</sub>CHNH<sub>2</sub>
- b.) (CH<sub>3</sub>)<sub>3</sub>N

- c.)  $(\text{CH}_3)_2\text{NH}$   
d.)  $\text{CH}_3\text{NH}_2$

**Correct Answer.** (c.)  $(\text{CH}_3)_2\text{NH}$

**Q3. Which element is contained by both amines and amides?**

**Answer.** Both amines and amides contain the element nitrogen.

**Q4. What are examples of amines?**

**Answer.** Amino acids, biogenic amines, trimethylamine, and aniline are essential amines; see Category: Amines for a list of amines. Ammonia inorganic derivatives are also known as amines, for example, monochloramine ( $\text{NClH}_2$ ). The amino group is called the substituent  $-\text{NH}_2$ .

**Q5. Give some uses of amines.**

**Answer.** Some of the uses of Amines are as follows-

- Amines are largely used in the pharmaceutical industry. Morphine and Demerol are used as analgesics that are pain killers.
- Novocaine is used as an anaesthetic and Ephedra is a very common decongestant. We use tetramethyl ammonium iodide for disinfecting drinking water.
- In daily life activities amines are used for pest control and tanning of leather. They find large applications in man-made dyes.
- Methamphetamines and amphetamines are recreational drugs. They are basic in nature with pH value above seven. Being basic in nature they are neutralized by the action of acids.
- The neutralization reaction results in the formation of alkylammonium salts which have many industrial uses.
- Choline is one of these salts which plays a significant role in the production of neurotransmitters in the human body to make the brain function properly.