Amines

Class 12 Chemistry · 24 NEET MCQs with answers & explanations

Amines covers classification, preparation, properties and reactions of nitrogen-containing organic compounds. NEET tests basicity order (aliphatic amines > NH_3 > aromatic amines), diazonium salt reactions, Hinsberg test, Hofmann bromamide degradation and carbylamine reaction. Basicity comparison is a NEET favourite.

Key Amine Concepts

Concept	Key Fact
Basicity order (gas)	3° > 2° > 1° > NH_3 (inductive effect only)
Basicity in water	2° > 1° > 3° > NH_3 (steric + solvation effects in solution)
Aniline basicity	Less basic than NH_3 (lone pair delocalised into benzene ring)
Hofmann bromamide	$R-CO-NH_2 + Br_2 + NaOH \rightarrow R-NH_2$ (one C less; amide → 1° amine)
Carbylamine reaction	1° amine + $CHCl_3$ + KOH → isocyanide (foul smell); test for 1° amines only
Diazonium salts	$ArNH_2 + NaNO_2 + HCl$ (0-5°C) → $ArN_2^+Cl^-$; Sandmeyer, Schiemann reactions

Questions

Q1. The correct decreasing order of basic strength among N-ethylethanamine, ethanamine, N-methylaniline and benzenamine is:

(A) N-ethylethanamine > ethanamine > N-methylaniline > benzenamine
(B) ethanamine > N-ethylethanamine > benzenamine > N-methylaniline
(C) benzenamine > N-methylaniline > ethanamine > N-ethylethanamine
(D) N-methylaniline > benzenamine > ethanamine > N-ethylethanamine

Q2. Why is sodium nitrite added slowly to a cold HCl solution of aniline during diazotization?

(A) To increase the reaction temperature
(B) To control HNO2 generation and prevent temperature rise that would decompose the diazonium salt
(C) To form HNO3 rapidly in the mixture
(D) To neutralize aniline before reaction

Q3. In the Hinsberg test, which amine gives a solid sulphonamide dissolving in aqueous alkali?

(A) Primary amine
(B) Secondary amine
(C) Tertiary amine
(D) Quaternary ammonium salt

Q4. Benzenediazonium chloride is treated with KI. The product formed is:

(A) Chlorobenzene
(B) Fluorobenzene
(C) Benzonitrile
(D) Iodobenzene

Q5. Which method converts an alkyl halide to a primary amine without changing the carbon chain length?

(A) Gabriel phthalimide synthesis
(B) Hoffmann bromamide reaction
(C) Reduction of nitrile
(D) Reductive amination

Q6. What is the major product when a primary aliphatic amine reacts with nitrous acid at 0–5°C?

(A) Alcohol with evolution of N_2 gas
(B) Stable diazonium salt
(C) Nitro compound
(D) Amide with no gas

Q7. Which amine is most basic in aqueous solution considering both inductive effect and solvation?

(A) $(CH_3)_2NH$
(B) CH_3NH_2
(C) $(CH_3)_3N$
(D) NH_3

Q8. Why is acetylation of aniline necessary before bromination or nitration?

(A) To increase water solubility
(B) To reduce $-NH_2$ activation and prevent polysubstitution
(C) To remove lone pair from nitrogen
(D) To speed up the reaction

Q9. Which statement correctly explains why primary amines have higher boiling points than tertiary amines of comparable molar mass?

(A) Primary amines form extensive intermolecular hydrogen bonding due to N-H bonds
(B) Tertiary amines have stronger van der Waals forces
(C) Primary amines have lower molecular mass
(D) Tertiary amines form stronger hydrogen bonds

Q10. Which of the following is a quaternary ammonium salt and NOT classified as an amine?

(A) $(CH_3)_3N$
(B) $C_6H_5NH_2$
(C) $(CH_3)_2NH$
(D) $(CH_3)_4N^+Cl^-$

Q11. The correct IUPAC name of CH_3NH_2 is

(A) Methylamine
(B) Methanamine
(C) Aminomethane
(D) Methylazane

Q12. Which set of conditions is essential for converting aniline to benzenediazonium chloride?

(A) $NaNO_2$ with HCl at 0–5°C to generate NO^+ and stabilize the diazonium salt
(B) HNO_3 with H_2SO_4 at 50°C to increase reaction rate
(C) Br_2 water at room temperature
(D) NaOH with heat to promote elimination

Q13. Which compound will NOT respond to carbylamine test despite containing nitrogen?

(A) $C_6H_5NH_2$
(B) $C_2H_5NH_2$
(C) $(CH_3)_2NH$
(D) CH_3NH_2

Q14. Aniline is significantly less basic than methylamine. Which explanation is correct?

(A) Methylamine lacks a lone pair on nitrogen
(B) Aniline has sp^3 N with tightly held lone pair
(C) Lone pair delocalizes into benzene ring via resonance
(D) Methylamine ionizes more readily due to larger size

Q15. The correct IUPAC name of $CH_3CH_2NH_2$ is

(A) Ethylamine
(B) Ethaneamine
(C) Ethanamine
(D) Aminoethane

Q16. The correct IUPAC name of $(CH_3)_2NH$ is

(A) Dimethylamine
(B) N-methylamine
(C) N-methylmethanamine
(D) N-ethylmethanamine

Q17. The correct IUPAC name of $C_2H_5NHCH_3$ is

(A) N-methylmethanamine
(B) N-methylethanamine
(C) N-ethylmethanamine
(D) Diethylamine

Q18. Which compound is correctly named N,N-dimethylethanamine?

(A) CH_3NHCH_3
(B) $(CH_3)_3N$
(C) $CH_3CH_2NH_2$
(D) $CH_3CH_2N(CH_3)_2$

Q19. The correct IUPAC name of $CH_3CH_2CH_2NH_2$ is

(A) Propan-1-amine
(B) Propylamine
(C) 1-aminopropane
(D) Propanamine

Q20. Which of the following correctly explains the use of the N-prefix in IUPAC nomenclature of amines?

(A) It indicates a substituent on the parent carbon chain
(B) It indicates a substituent is attached to the nitrogen atom
(C) It denotes a nitro compound
(D) It is used only for tertiary amines

Q21. The correct IUPAC name of $CH_3CH(NH_2)CH_3$ is

(A) Propan-2-amine
(B) 2-aminopropane
(C) Isopropylamine
(D) Propanamine

Q22. Which of the following is the correct IUPAC name of $C_6H_5CH_2NH_2$?

(A) Benzylamine
(B) Phenylmethanamine
(C) Aminobenzene
(D) Aniline

Q23. Which compound is correctly named ethanamine?

(A) CH_3NH_2
(B) $CH_3CH_2NH_2$
(C) $(CH_3)_2NH$
(D) $CH_3CH_2CH_2NH_2$

Q24. In IUPAC nomenclature, the suffix '-amine' is used when NH_2 is

(A) A substituent on a ring
(B) The principal functional group of the molecule
(C) Present along with a carboxylic acid group
(D) Attached to a benzene ring only

Answer key

1-A	2-B	3-A	4-D	5-A	6-A	7-A	8-B
9-A	10-D	11-B	12-A	13-C	14-C	15-C	16-C
17-B	18-D	19-A	20-B	21-A	22-B	23-B	24-B

Answers with explanations

Q1 — Answer: (A) N-ethylethanamine > ethanamine > N-methylaniline > benzenamine
In aqueous medium, secondary aliphatic amines are most basic due to +I effect and effective solvation of the conjugate acid. Primary aliphatic amines rank next. Aromatic amines are weaker because the nitrogen lone pair is delocalised into the benzene ring, reducing availability for protonation. N-methylaniline is more basic than benzenamine because one alkyl group partially offsets resonance loss. The correct order is therefore N-ethylethanamine > ethanamine > N-methylaniline > benzenamine.

Q2 — Answer: (B) To control HNO2 generation and prevent temperature rise that would decompose the diazonium salt
Controlled dropwise addition of NaNO2 ensures steady in situ generation of HNO2 and prevents local excess, which would raise temperature and decompose the diazonium salt before collection. Slow addition is essential for yield, not just safety.

Q3 — Answer: (A) Primary amine
A primary amine reacts with benzenesulphonyl chloride to form a sulphonamide with an acidic N−H proton. This N−H is ionised by alkali, giving a soluble sodium salt. Secondary-amine sulphonamides lack N−H and remain insoluble. Tertiary amines do not react with Hinsberg reagent.

Q4 — Answer: (D) Iodobenzene
Iodide ion displaces the diazonium group directly without a copper catalyst, producing iodobenzene with release of nitrogen gas. CuCl gives chlorobenzene (Sandmeyer); CuCN gives benzonitrile; HBF4 then heat gives fluorobenzene.

Q5 — Answer: (A) Gabriel phthalimide synthesis
Gabriel synthesis uses the alkyl halide directly via SN2 on potassium phthalimide, so the product amine has the same carbon count as the alkyl halide. Nitrile reduction adds one carbon; Hoffmann reaction removes one carbon — both alter chain length.

Q6 — Answer: (A) Alcohol with evolution of N_2 gas
Primary aliphatic amines form highly unstable aliphatic diazonium salts that immediately decompose, yielding the corresponding alcohol with brisk N_2 evolution. Option B is the trap — stable diazonium salts form only with aromatic primary amines.

Q7 — Answer: (A) $(CH_3)_2NH$
Dimethylamine balances maximum inductive effect with efficient solvation of its conjugate acid (dimethylammonium ion has two N-H bonds for H-bonding with water). Trimethylamine (C) has stronger inductive effect but its conjugate acid has only one N-H, severely limiting solvation. This solvation deficit drops $(CH_3)_3N$ below $(CH_3)_2NH$ in aqueous basicity.

Q8 — Answer: (B) To reduce $-NH_2$ activation and prevent polysubstitution
Acetylation converts $-NH_2$ to $-NHCOCH_3$, a less activating amide group that allows controlled monosubstitution. Without protection, the highly activating $-NH_2$ causes rapid polysubstitution. Option D reverses the effect — acetylation slows, not speeds, EAS.

Q9 — Answer: (A) Primary amines form extensive intermolecular hydrogen bonding due to N-H bonds
Primary amines possess two N-H bonds enabling strong intermolecular hydrogen bonding, significantly raising boiling point. Tertiary amines have no N-H bonds and cannot form intermolecular hydrogen bonds, hence lower boiling points. Van der Waals forces alone cannot compensate for absence of H-bonding.

Q10 — Answer: (D) $(CH_3)_4N^+Cl^-$
Quaternary ammonium salts have four organic groups on nitrogen with a positive charge and no lone pair available — they are not amines. $(CH_3)_4N^+Cl^-$ fits this definition. All other options are amines with at least one lone pair on nitrogen.

Q11 — Answer: (B) Methanamine
Methanamine is the preferred IUPAC name for CH_3NH_2; the parent chain is methane with the suffix -amine. Methylamine is a retained common name, not strict IUPAC. Aminomethane and methylazane are non-standard forms.

Q12 — Answer: (A) NaNO2 with HCl at 0–5°C to generate NO+ and stabilize the diazonium salt
NaNO2 and HCl generate HNO2 in situ which produces the electrophilic NO+. Low temperature (0–5°C) is mandatory because diazonium salts are thermally unstable and decompose above this range. Option B uses wrong reagents and wrong temperature.

Q13 — Answer: (C) $(CH_3)_2NH$
Carbylamine test is specific to primary amines — only they possess the N-H bond needed to react with dichlorocarbene ($:CCl_2$) generated from $CHCl_3$/KOH. Secondary amines ($(CH_3)_2NH$) contain nitrogen but lack primary N-H, so no isocyanide forms. Aniline (A) is primary aromatic — it does give a positive test.

Q14 — Answer: (C) Lone pair delocalizes into benzene ring via resonance
Resonance interaction between aniline's N lone pair and the benzene ring reduces electron density on nitrogen, making it far less available for protonation. Option B is the trap — aniline's nitrogen is actually sp^2 hybridized, not sp^3.

Q15 — Answer: (C) Ethanamine
Ethanamine follows IUPAC rules: parent chain ethane + suffix -amine. Ethylamine is the common name. Ethaneamine is a misspelling — the correct suffix drops the terminal 'e' of the alkane before adding -amine.

Q16 — Answer: (C) N-methylmethanamine
$(CH_3)_2NH$ has two methyl groups on nitrogen; IUPAC names the longer (or either equal) chain as parent — methanamine — and the N-substituent as N-methyl, giving N-methylmethanamine. Dimethylamine is the common name only.

Q17 — Answer: (B) N-methylethanamine
The longest chain on nitrogen is ethane (parent: ethanamine); the shorter methyl group is the N-substituent, giving N-methylethanamine. N-ethylmethanamine would mean the ethyl is on N and methane is the parent — reversed assignment.

Q18 — Answer: (D) $CH_3CH_2N(CH_3)_2$
N,N-dimethylethanamine has ethane as the parent chain and two methyl groups on nitrogen. $CH_3CH_2N(CH_3)_2$ fits this structure. $(CH_3)_3N$ is trimethylamine — all three groups equal, parent is methanamine.

Q19 — Answer: (A) Propan-1-amine
NH_2 is on C-1 of the three-carbon chain; strict IUPAC requires the locant, giving propan-1-amine. Propanamine without a locant is incomplete when positional ambiguity exists. Propylamine is the common name.

Q20 — Answer: (B) It indicates a substituent is attached to the nitrogen atom
In IUPAC nomenclature, N- before a substituent name specifies that the group is bonded to nitrogen, not to a carbon of the parent chain. This distinguishes N-methylethanamine (methyl on N) from 2-methylpropanamine (methyl on C-2).

Q21 — Answer: (A) Propan-2-amine
The NH_2 group is on C-2 of the propane chain; IUPAC suffix naming gives propan-2-amine. 2-Aminopropane uses NH_2 as a prefix, which applies only when NH_2 is not the principal group. Isopropylamine is the common name.

Q22 — Answer: (B) Phenylmethanamine
The strict IUPAC name of $C_6H_5CH_2NH_2$ is phenylmethanamine — methane is the parent chain with NH_2 (suffix) and phenyl on C-1. Benzylamine is an acceptable common name. Aniline and aminobenzene refer to $C_6H_5NH_2$, not the benzyl compound.

Q23 — Answer: (B) $CH_3CH_2NH_2$
Ethanamine has the two-carbon ethane backbone with NH_2 as the principal group. CH_3NH_2 is methanamine; $(CH_3)_2NH$ is N-methylmethanamine; $CH_3CH_2CH_2NH_2$ is propan-1-amine.

Q24 — Answer: (B) The principal functional group of the molecule
When NH_2 is the principal functional group, IUPAC uses the suffix -amine (e.g., ethanamine). If a higher-priority group like –COOH is present, NH_2 is expressed as the prefix amino- instead.

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