

CLASS 12

CHEMISTRY

EXTRA QUESTIONS

Class 12 Chemistry Chapter 9 Amines – Extra Questions with Answers

These extra practice questions for Class 12 Chemistry Chapter 9 – Amines go beyond the NCERT textbook exercises to reinforce basicity trends, diazonium salt chemistry, and the tests used to identify and distinguish amines. Useful for board exam revision and quick concept checks.

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Very Short Answer Type Questions (1 Mark)

Q1. Name the test used to distinguish a primary amine from secondary and tertiary amines.

Ans: The **carbylamine test** ($\text{CHCl}_3 + \text{alc. KOH}$, heat) — only primary amines (aliphatic or aromatic) give the foul-smelling isocyanide; secondary and tertiary amines give no reaction.

Q2. At what temperature is a diazonium salt prepared, and why?

Ans: **273–278K (0–5°C)**. Diazonium salts are thermally unstable and decompose readily above this range, releasing N_2 gas; low temperature keeps decomposition slow enough for the salt to be isolated and used.

Q3. Which reagent converts a benzenediazonium salt directly into fluorobenzene?

Ans: **HBF_4** (fluoroboric acid), followed by heating the dry diazonium fluoroborate salt — the **Balz–Schiemann reaction**.

Q4. Arrange in increasing order of basic strength (aqueous): $(\text{C}_2\text{H}_5)_3\text{N}$, $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$.

Ans: **$(\text{C}_2\text{H}_5)_3\text{N} < \text{C}_2\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH}$** . In water, the tertiary amine's bulky, poorly-solvated ammonium ion makes it the weakest base of the three despite having the most alkyl groups.

Short Answer Type Questions (2–3 Marks)

Q5. Why does aniline not undergo Friedel-Crafts alkylation or acylation, even though $-\text{NH}_2$ is an activating group?

Ans: The Lewis acid catalyst (AlCl_3) used in Friedel-Crafts reactions is itself an electrophile that coordinates strongly with aniline's basic nitrogen lone pair, forming a salt-like $-\text{NH}_2 \rightarrow \text{AlCl}_3$ complex. This converts the ring-activating $-\text{NH}_2$ group into a strongly deactivating, bulky substituent, so the reaction fails (or gives very poor yields) instead of proceeding as it would for a typical activated arene.

Q6. Explain why the coupling reaction of a diazonium salt with phenol is carried out in mildly alkaline medium, while with aniline it is carried out in mildly acidic medium.

Ans: With **phenol**, a mildly alkaline medium converts some phenol into the more strongly activating phenoxide ion ($\text{C}_6\text{H}_5\text{O}^-$), which couples efficiently with the diazonium electrophile; too strongly alkaline conditions instead destroy the diazonium salt itself (converting it to a diazotate). With **aniline**, a mildly acidic medium keeps most of the aniline as the free (unprotonated, still nucleophilic-at-the-ring) amine rather than the fully protonated, deactivated anilinium ion, while still being acidic enough to prevent the diazonium salt from decomposing.

Q7. What happens when benzenediazonium chloride is warmed with water? Write the equation.

Ans: The diazonium group is hydrolysed and replaced by $-\text{OH}$, releasing nitrogen gas:
 $\text{C}_6\text{H}_5\text{N}_2\text{Cl} + \text{H}_2\text{O} \rightarrow (\Delta) \rightarrow \text{C}_6\text{H}_5\text{OH} + \text{N}_2 + \text{HCl}$. This is a standard route to phenol from aniline via diazotisation.

Higher Order Thinking Skills (HOTS)

Q8. A student says: "Since aniline's nitrogen lone pair is delocalised into the ring, the ring should be deactivated towards electrophilic substitution, just as it is deactivated towards forming a stronger base." Is this reasoning correct? Explain with reference to aniline's actual behaviour in bromination.

Ans: The reasoning is **incorrect**. Delocalisation of the nitrogen lone pair into the ring is exactly what makes

aniline strongly **activating** (electron-rich) towards electrophilic aromatic substitution — the same delocalisation that reduces the lone pair's availability for protonation (lowering basicity) simultaneously increases electron density at the ortho/para ring positions (raising reactivity towards electrophiles). This is why aniline reacts instantly with bromine water at room temperature, with no catalyst, to give a white precipitate of 2,4,6-tribromoaniline — a textbook demonstration of the ring being strongly activated even as the nitrogen itself is a weaker base than an aliphatic amine.

Q9. Two isomeric amines, C_3H_9N , are treated separately with HNO_2 at 273K. One sample effervesces briskly with N_2 gas; the other shows no visible gas evolution but forms a yellow oily layer. Identify the class of each amine and explain the difference in behaviour.

Ans: The sample effervescing briskly with N_2 is a **primary aliphatic amine** (e.g. propan-1-amine or propan-2-amine) — its diazonium salt is too unstable to exist even briefly and decomposes instantly, releasing nitrogen gas and forming a carbocation that goes on to alcohol/alkene products. The sample forming a yellow oily layer with no gas is a **secondary amine** (e.g. N-methylethanamine) — it reacts with HNO_2 to form a stable N-nitrosamine (a yellow oil) rather than releasing nitrogen, since it has no N–H available for the diazotisation pathway that primary amines follow.

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