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Amines — CBSE Class 12 Chemistry Chapter Test

FREE CHAPTER TEST · CLASS XII · CHEMISTRY (043) · PATTERN OF THE CBSE SAMPLE QUESTION PAPER 2026-27

TIME ALLOWED	MAXIMUM MARKS	QUESTIONS	NAME / ROLL NO.
1½ hours	37	17 (A 8 · B 3 · C 3 · D 1 · E 2)	

GENERAL INSTRUCTIONS

Read the following instructions very carefully and strictly follow them:

1. This question paper contains 17 questions. All questions are compulsory.
2. This question paper is divided into five sections: A, B, C, D and E.
3. Section A (Q1–8) contains 6 multiple choice questions and 2 assertion-reason based questions of 1 mark each.
4. Section B (Q9–11) contains short answer questions of 2 marks each.
5. Section C (Q12–14) contains short answer questions of 3 marks each.
6. Section D (Q15) contains case-based questions of 4 marks each, with sub-parts of 1, 1 and 2 marks.
7. Section E (Q16–17) contains long answer questions of 5 marks each.
8. There is no overall choice. However, an internal choice has been provided in 1 question in Section B, 1 question in Section C, 1 question in Section D, 2 questions in Section E. Attempt only one of the alternatives in such questions.
9. Use of log tables and calculators is not allowed.
10. This chapter test follows the section structure, question types and marks per question of the CBSE Class XII Chemistry (043) Sample Question Paper 2026-27, at about half the length of the 70-mark board paper: 37 marks in 1½ hours.
11. The answer key and the marking scheme are at the end of this booklet. Attempt the paper in 1½ hours before you look at them.

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Chapter: Amines · **Topics:** Classification and nomenclature · Preparation of amines · Physical properties · Basic character of amines · Chemical reactions of amines · Diazonium salts and their reactions

SECTION A

This section comprises 8 questions of 1 mark each: 6 multiple choice questions (MCQs) and 2 assertion-reason based questions.

1. Which of the following is a secondary amine? 1

(A) N-Methylethanamine (B) Propan-2-amine

(C) N,N-Dimethylmethanamine (D) 2-Methylpropan-2-amine

2. Benzamide is heated with bromine and aqueous sodium hydroxide. The product is 1

(A) benzylamine (B) benzoic acid

(C) benzonitrile (D) aniline

3. The carbylamine test (warming with chloroform and alcoholic KOH) is given by 1

(A) secondary amines (B) primary amines

(C) tertiary amines (D) quaternary ammonium salts

4. The Gabriel phthalimide synthesis is used to prepare 1

(A) aniline (B) tertiary amines

(C) primary aliphatic amines (D) secondary amines

5. Benzenediazonium chloride reacts with hypophosphorous acid (H_3PO_2) to give 1

(A) benzene (B) phenol

(C) chlorobenzene (D) aniline

6. Aniline reacts with bromine water at room temperature to give 1

(A) 4-bromoaniline (B) 2-bromoaniline

(C) 2,4,6-tribromoaniline (D) 3-bromoaniline

7. **Assertion (A) :** Aniline is a stronger base than ammonia. 1

Reason (R) : In aniline, the lone pair of electrons on nitrogen is delocalised over the benzene ring.

(A) Both A and R are true, and R is the correct explanation of A.

(B) Both A and R are true, and R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

8. **Assertion (A) :** Aniline does not undergo the Friedel-Crafts reaction. 1

Reason (R) : Freshly distilled aniline is colourless but darkens on storage in air.

(A) Both A and R are true, and R is the correct explanation of A.

(B) Both A and R are true, and R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

SECTION B

This section comprises 3 short answer questions of 2 marks each.

9. Write the IUPAC names of (i) $CH_3NHCH(CH_3)_2$ and (ii) $C_6H_5N(CH_3)_2$. 2

10. (a) Why does aniline dissolve in dilute hydrochloric acid although it is only slightly soluble in water? Why does aqueous methylamine give a reddish-brown precipitate with iron(III) chloride solution? 2

OR

(b) Write the equation for the carbylamine reaction, and state its use.

11. Write the equations for the preparation of (i) aniline from nitrobenzene and (ii) ethanamine from ethanenitrile. 2

SECTION C

This section comprises 3 short answer questions of 3 marks each.

12. (a) Arrange NH_3, CH_3NH_2, $(CH_3)_2NH$ and $(CH_3)_3N$ in order of increasing basic strength in aqueous solution. Explain the position of $(CH_3)_3N$. 3

OR

(b) Describe the Gabriel phthalimide synthesis of a primary amine. Why can it not be used to prepare aniline?

13. Starting from aniline, show with equations how you would prepare (i) benzonitrile, (ii) fluorobenzene and (iii) bromobenzene. (The first step in each is the same.) 3

14. Direct nitration of aniline gives a large amount of the meta product along with tarry oxidation products. Explain why, and show how 4-nitroaniline can be obtained from aniline as the main product. 3

SECTION D

This section comprises 1 case-based question of 4 marks, with sub-parts of 1, 1 and 2 marks.

15. Many dyes are made from aromatic amines. Aniline is first converted into benzenediazonium chloride by treating it with sodium nitrite and hydrochloric acid at 273–278 K. The diazonium salt is then 'coupled' with phenol in alkaline solution to give an orange dye, 4-hydroxyazobenzene, in which the two benzene rings are joined by an –N=N– group.

(I) Why must the diazotisation be carried out at 273–278 K? [1]

(II) At which position of the phenol ring does the diazonium ion attack? [1]

(III) Write the equations for the diazotisation of aniline and for the coupling of the diazonium salt with phenol. [2]

OR

(III) Write the equations for the conversion of benzenediazonium chloride into chlorobenzene by the Sandmeyer reaction and by the Gattermann reaction. [2]

SECTION E

This section comprises 2 long answer questions of 5 marks each.

16. (a) (i) Write the equation for the Hoffmann bromamide degradation of ethanamide. What is special about the amine formed? 5

(ii) Why does the ammonolysis of an alkyl halide give a mixture of products? How can a primary amine be made the main product?

(iii) Write the equation for the reduction of an amide to an amine.

OR

(b) (i) How does Hinsberg's reagent distinguish primary, secondary and tertiary amines? Give the equation for the primary amine.

(ii) Write the products of the reaction of nitrous acid with a primary aliphatic amine and with aniline.

17. (a) (i) Arrange the isomeric amines butan-1-amine, N-ethylethanamine and N,N-dimethylethanamine in order of decreasing boiling point, and explain the order. 5

(ii) Arrange aniline, 4-nitroaniline and 4-methylaniline in order of increasing basic strength, and explain.

(iii) Why are arenediazonium salts more stable than alkyldiazonium salts?

OR

(b) (i) Write the equation for the acylation of ethanamine with ethanoyl chloride. Why is the reaction carried out in the presence of pyridine?

(ii) What is formed when aniline is heated with concentrated sulphuric acid at 453–473 K?

(iii) Write the equation for the exhaustive methylation of methylamine with excess bromomethane, and name the type of product.

END OF THE QUESTION PAPER

ANSWER KEY — SECTION A

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
(A)	(D)	(B)	(C)	(A)	(C)	(D)	(B)

MARKING SCHEME AND WORKED SOLUTIONS

Marks for each step are shown in brackets, as in the CBSE marking scheme. Any correct alternative method earns full marks.

Q1. Answer (A). In N-methylethanamine, $CH_3NHC_2H_5$, two alkyl groups are on the nitrogen. Propan-2-amine and 2-methylpropan-2-amine are primary amines (one alkyl group on N), and N,N-dimethylmethanamine is tertiary.

Q2. Answer (D). Hoffmann bromamide degradation gives an amine with one carbon atom fewer: $C_6H_5CONH_2 \rightarrow C_6H_5NH_2$.

Q3. Answer (B). Only primary amines give the foul-smelling isocyanide.

Q4. Answer (C). Aryl halides do not undergo nucleophilic substitution with the phthalimide anion, so aromatic amines cannot be made this way.

Q5. Answer (A). H_3PO_2 (or ethanol) replaces the diazo group by hydrogen.

Q6. Answer (C). The $–NH_2$ group strongly activates the ring, so all ortho and para positions are brominated at once (white precipitate).

Q7. Answer (D). Because the lone pair is delocalised (less available for a proton), aniline is a weaker base than ammonia: A is false, R is true. Answer D.

Q8. Answer (B). Both are true; aniline fails the Friedel-Crafts reaction because it forms a salt with $AlCl_3$ (deactivating the ring), which has nothing to do with its slow oxidation in air. Answer B.

Q9. (2 marks) Answer: N-methylpropan-2-amine; N,N-dimethylbenzenamine.
(i) N-Methylpropan-2-amine. [1]
(ii) N,N-Dimethylbenzenamine (N,N-dimethylaniline). [1]

Q10. (2 marks) Answer: (a) forms soluble anilinium chloride; $Fe(OH)_3$ precipitate; (b) isocyanide test for 1° amines.
(a) Aniline is a base: with HCl it forms the ionic salt anilinium chloride, $C_6H_5NH_3^+Cl^-$, which is soluble in water. [1] Methylamine is basic and gives OH^- ions in water, which precipitate hydrated iron(III) oxide: $FeCl_3 + 3CH_3NH_2 + 3H_2O \rightarrow Fe(OH)_3 + 3CH_3NH_3^+Cl^-$. [1]
OR (b) $R–NH_2 + CHCl_3 + 3KOH$ (alcoholic, warm) $\rightarrow R–NC + 3KCl + 3H_2O$. [1] Used to test for primary amines: only they give the foul-smelling isocyanide. [1]

Q11. (2 marks) Answer: Sn/HCl; $LiAlH_4$ (or Na/ethanol).
(i) $C_6H_5NO_2 + 6[H]$ (Sn/HCl or Fe/HCl) $\rightarrow C_6H_5NH_2 + 2H_2O$. [1]
(ii) $CH_3CN + 4[H]$ ($LiAlH_4$, or Na/C_2H_5OH) $\rightarrow CH_3CH_2NH_2$. [1]

Q12. (3 marks) Answer: (a) $NH_3 < (CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$; (b) Gabriel synthesis.
(a) $NH_3 < (CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$. [1]
The +I effect of the methyl groups raises the basicity of all the amines above that of NH_3. [1] For $(CH_3)_3N$, its cation has only one N–H hydrogen for hydrogen bonding with water (poor solvation), and three methyl groups crowd the nitrogen, so in water it is weaker than the 1° and 2° amines. [1]
OR (b) Phthalimide + ethanolic KOH $\rightarrow$ potassium phthalimide; + R–X $\rightarrow$ N-alkylphthalimide; hydrolysis with NaOH (aq) $\rightarrow R–NH_2$ + sodium phthalate. [2] Aryl halides do not undergo nucleophilic substitution with the phthalimide anion, so aromatic primary amines cannot be made this way. [1]

Q13. (3 marks) Answer: diazotisation, then CuCN, HBF_4, CuBr.
Diazotisation: $C_6H_5NH_2 + NaNO_2 + 2HCl$ (273–278 K) → $C_6H_5N_2^+Cl^- + NaCl + 2H_2O$. [1]
(i) $C_6H_5N_2^+Cl^- + CuCN/KCN \rightarrow C_6H_5CN + N_2$. (ii) $C_6H_5N_2^+Cl^- + HBF_4 \rightarrow C_6H_5N_2^+BF_4^-$; heat → $C_6H_5F + BF_3 + N_2$ (Balz-Schiemann). [1]
(iii) $C_6H_5N_2^+Cl^- + CuBr/HBr \rightarrow C_6H_5Br + N_2$ (Sandmeyer). [1]

Q14. (3 marks) Answer: anilinium ion is m-directing; acetylate, nitrate, hydrolyse.
In the strongly acidic nitrating mixture aniline is protonated to the anilinium ion, $C_6H_5NH_3^+$, which is meta-directing; the free amine is also oxidised by nitric acid. [1]
Protect the $–NH_2$ group by acetylation: $C_6H_5NH_2 + (CH_3CO)_2O \rightarrow C_6H_5NHCOCH_3 + CH_3COOH$. The $–NHCOCH_3$ group is less activating and o,p-directing; nitration gives mainly 4-nitroacetanilide. [1]
Acid or base hydrolysis removes the acetyl group: $4\text{-}O_2NC_6H_4NHCOCH_3 + H_2O \rightarrow 4\text{-}O_2NC_6H_4NH_2 + CH_3COOH$. [1]

Q15. (4 marks) Answer: (I) unstable above 278 K; (II) para; (III) equations.
(I) Benzenediazonium chloride is unstable and decomposes (to phenol and N_2) at higher temperatures. [1]
(II) The para position (to the –OH group). [1]
(III) $C_6H_5NH_2 + NaNO_2 + 2HCl \rightarrow C_6H_5N_2^+Cl^- + NaCl + 2H_2O$. [1] $C_6H_5N_2^+Cl^- + C_6H_5OH + NaOH \rightarrow 4\text{-}HOC_6H_4–N{=}N–C_6H_5 + NaCl + H_2O$. [1]
OR (III) Sandmeyer: $C_6H_5N_2^+Cl^- + Cu_2Cl_2/HCl \rightarrow C_6H_5Cl + N_2$. [1] Gattermann: $C_6H_5N_2^+Cl^- + Cu/HCl \rightarrow C_6H_5Cl + N_2$. [1]

Q16. (5 marks) Answer: (a) CH_3NH_2 (one carbon fewer); excess NH_3; $LiAlH_4$; (b) Hinsberg test; alcohol + N_2 or diazonium salt.
(a) (i) $CH_3CONH_2 + Br_2 + 4NaOH \rightarrow CH_3NH_2 + Na_2CO_3 + 2NaBr + 2H_2O$. [1] The amine has one carbon atom fewer than the amide. [1]
(ii) The primary amine formed is itself a nucleophile and reacts with more alkyl halide, giving secondary and tertiary amines and the quaternary salt. [1] Using a large excess of ammonia makes the primary amine the main product. [1]
(iii) $CH_3CONH_2 + 4[H]$ ($LiAlH_4$, then H_2O) → $CH_3CH_2NH_2 + H_2O$. [1]
OR (b) (i) Hinsberg's reagent is benzenesulphonyl chloride, $C_6H_5SO_2Cl$. [½] A primary amine gives N-alkylbenzenesulphonamide, which dissolves in alkali (it has an acidic N–H): $C_6H_5SO_2Cl + C_2H_5NH_2 \rightarrow C_6H_5SO_2NHC_2H_5 + HCl$. [1] A secondary amine gives N,N-dialkylbenzenesulphonamide, insoluble in alkali (no N–H). [1] A tertiary amine does not react. [½]
(ii) Primary aliphatic amines give alcohols with nitrogen gas: $RNH_2 + HNO_2 \rightarrow ROH + N_2 + H_2O$. [1] Aromatic primary amines at 273–278 K give diazonium salts: $C_6H_5NH_2 + NaNO_2 + 2HCl \rightarrow C_6H_5N_2^+Cl^- + NaCl + 2H_2O$. [1]

Q17. (5 marks) Answer: (a) 1° > 2° > 3°; 4-nitroaniline < aniline < 4-methylaniline; aryl diazonium ion resonance-stabilised; (b) acylation, sulphanilic acid, quaternary salt.
(a) (i) Butan-1-amine > N-ethylethanamine > N,N-dimethylethanamine. [1] Primary amines have two N–H hydrogens for intermolecular hydrogen bonding, secondary one and tertiary none. [1]
(ii) 4-Nitroaniline < aniline < 4-methylaniline. [1] The electron-withdrawing $–NO_2$ group reduces the electron density on N (and delocalises the lone pair further); the electron-releasing $–CH_3$ group increases it. [1]
(iii) In an arenediazonium ion the positive charge is delocalised over the benzene ring by resonance, which stabilises it; an alkyldiazonium ion has no such resonance and loses N_2 at once. [1]
OR (b) (i) $C_2H_5NH_2 + CH_3COCl \rightarrow C_2H_5NHCOCH_3 + HCl$. [1] Pyridine removes the HCl formed, shifting the equilibrium to the right. [1]
(ii) $C_6H_5NH_2 + H_2SO_4$ (conc.) → anilinium hydrogensulphate; heated at 453–473 K → 4-aminobenzenesulphonic acid (sulphanilic acid), which exists as a zwitterion. [1]
(iii) $CH_3NH_2 + 3CH_3Br \rightarrow (CH_3)_4N^+Br^- + 2HBr$ (the HBr is taken up by base); the product is a quaternary ammonium salt. [2]

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