SmartKalike

CBSE Class 12 · Chemistry

Amines

10 most probable questions for Boards 2027

Q1. 1 mark · Very short answer

What is the approximate C–N–C bond angle in trimethylamine?

Answer

The C–N–C bond angle in trimethylamine is approximately 108°, less than 109.5° because nitrogen has an unshared pair of electrons.

Q2. 2 marks · Short answer

Classify amines as primary, secondary or tertiary according to their structure. Distinguish between simple and mixed amines.

Answer

1. Number of ammonia hydrogen atoms replaced — primary amines have one replaced (RNH_2 or $ArNH_2$), secondary amines have two (R–NHR′), and tertiary amines have three alkyl or aryl groups attached to nitrogen.
2. Identity of the groups — simple amines have identical alkyl or aryl groups, whereas mixed amines have different groups.

Q3. 3 marks · Medium answer

Describe two methods for reducing nitro compounds to amines. Why are iron scrap and hydrochloric acid commonly preferred?

Answer

1. Nitro compounds are reduced by passing hydrogen gas in the presence of finely divided nickel, palladium or platinum. They can also be reduced with metals in an acidic medium.
2. Iron scrap and hydrochloric acid are preferred because $FeCl_2$ formed is hydrolysed, releasing hydrochloric acid during the reaction. Thus, only a small amount of hydrochloric acid is required to initiate the reaction.

Q4. 5 marks · Long answer

Explain how diazonium salts help prepare substituted aromatic compounds that cannot be obtained readily by direct substitution in benzene or substituted benzene. Give suitable examples involving replacement of the diazonium group.

Answer

Aryldiazonium salts provide a versatile route to substituted aromatic compounds through replacement of the diazonium group.
1. The diazonium group can be replaced by chlorine, bromine or cyanide using suitable copper(I) salts. Cyanobenzene is readily obtained this way, although the cyano group cannot be introduced by nucleophilic substitution of chlorine in chlorobenzene.

2. Aryl fluorides are prepared by heating diazonium fluoroborates, while potassium iodide replaces the diazonium group with iodine. Aryl fluorides and iodides cannot be prepared by direct halogenation.
3. Allowing the diazonium salt solution temperature to rise to 283 K hydrolyses the salt to phenol, replacing the diazonium group with –OH.
4. Heating diazonium fluoroborate with aqueous sodium nitrite in the presence of copper replaces the diazonium group with $–NO_2$.
Thus, diazonium salts make possible the preparation of substituted aromatic compounds that are difficult to obtain by direct substitution.

Q5. 6 marks · Very long answer

(a) Describe the steps of Gabriel phthalimide synthesis for preparing a primary amine from an alkyl halide. State its limitation for preparing aromatic primary amines. (b) Describe the Hoffmann bromamide degradation, including the change in carbon number and the group migration involved.

Answer

Gabriel phthalimide synthesis prepares primary amines from alkyl halides, while Hoffmann bromamide degradation prepares primary amines from amides.
1. Phthalimide is treated with ethanolic potassium hydroxide to form potassium salt of phthalimide.
2. The potassium salt is heated with an alkyl halide, and the product is then subjected to alkaline hydrolysis to yield the corresponding primary amine.
3. Aromatic primary amines cannot be prepared by Gabriel synthesis because aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.
4. The Hoffmann bromamide degradation reaction treats an amide with bromine in an aqueous or ethanolic solution of sodium hydroxide.
5. An alkyl or aryl group migrates from the carbonyl carbon of the amide to the nitrogen atom, and the resulting amine contains one carbon less than the amide.
6. For example, butanamide gives propanamine; the amide has four carbon atoms and the amine has three.
Thus, Gabriel synthesis is limited to alkyl halides, whereas Hoffmann bromamide degradation shortens the carbon chain by one carbon atom.

Q6. 7 marks · Very long answer

(a) Explain how primary, secondary and tertiary amines are classified in relation to ammonia. (b) Classify CH3NH2, (CH3)2NH and (CH3)3N. (c) Explain what is meant by simple and mixed amines, giving one example of each.

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/amines

Q7. 1 mark · Multiple choice

Which of the following is a secondary amine? (A) CH3NH2 (B) (CH3)2NH (C) (CH3)3N (D) C6H5NH2

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/amines

Q8. 2 marks · Short answer

Why is ammonolysis of an alkyl halide not a good method for preparing a pure primary amine?

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Q9. 3 marks · Medium answer

Explain why lower aliphatic amines dissolve in water, and why the solubility decreases as the molar mass of the amine increases.

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Q10. 5 marks · Long answer

(a) Name the reagent used to reduce an amide to an amine. (1)
(b) Describe Gabriel phthalimide synthesis of a primary amine, and state its limitation for preparing aromatic primary amines. (2)
(c) Explain the carbon-number change and group migration in the Hoffmann bromamide degradation reaction. (2)

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