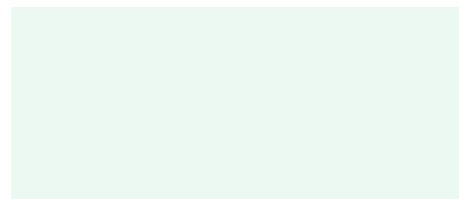


Amines Lecture Notes Summary



Lecture Notes on Amines

1. Introduction to Amines

- **Definition:** Amines are organic compounds derived by replacing hydrogen atoms in an ammonia molecule (NH_3) with alkyl or aryl groups.
- **Occurrence:** Found in proteins, vitamins, hormones, and alkaloids. Common synthetic amines include drugs like adrenaline, ephedrine, and Benadryl.
- **Uses:** Amines are used in making polymers, dyes, medicines, and surfactants.

2. Classification of Amines

- **Based on Substitution:**
 - **Primary (1°) amine:** One hydrogen atom of ammonia is replaced by an alkyl or aryl group (e.g., RNH_2).
 - **Secondary (2°) amine:** Two hydrogen atoms are replaced (e.g., R_2NH).
 - **Tertiary (3°) amine:** All three hydrogen atoms are replaced (e.g., R_3N).
- **Simple vs. Mixed Amines:**
 - **Simple amines:** All alkyl or aryl groups are the same.
 - **Mixed amines:** Alkyl or aryl groups are different.

3. Nomenclature

- **Common system:** Name alkyl groups followed by "amine" (e.g., methylamine).
- **IUPAC system:** Replace the 'e' of the parent alkane with 'amine' (e.g., methanamine).
- **Aryl amines:** Simplest example is aniline ($\text{C}_6\text{H}_5\text{NH}_2$).

4. Preparation of Amines

- **Reduction of Nitro Compounds:** Using H_2 with Ni, Pd, or Pt, or reduction with metals in acidic medium.
- **Ammonolysis of Alkyl Halides:** Alkyl halides react with ammonia to form primary amines.
- **Reduction of Nitriles:** Lithium aluminium hydride (LiAlH_4) or catalytic hydrogenation converts nitriles to primary amines.
- **Gabriel Phthalimide Synthesis:** Produces primary amines from alkyl halides.
- **Hoffmann Bromamide Degradation:** Reduces amides to amines with one carbon less.

5. Physical Properties

- **States:** Lower aliphatic amines are gases, and higher amines are liquids or solids.
- **Odor:** Aliphatic amines have a fishy odor.
- **Solubility:** Lower amines are soluble in water due to hydrogen bonding, but solubility decreases with increasing molecular weight.
- **Boiling Points:** The order is primary > secondary > tertiary, due to intermolecular hydrogen bonding.

6. Chemical Reactions of Amines

- **Basicity:** Amines act as bases, forming ammonium salts with acids.
- **Alkylation:** React with alkyl halides to form higher amines.
- **Acylation:** Primary and secondary amines react with acyl chlorides or anhydrides to form amides.
- **Carbylamine Reaction:** Primary amines react with chloroform and KOH to form foul-smelling isocyanides, useful for testing primary amines.
- **Reaction with Nitrous Acid:**
 - **Primary amines** form diazonium salts (useful for aromatic amines).
 - **Secondary amines** give nitrosoamines.
- **Hinsberg Test:** Differentiates primary, secondary, and tertiary amines by their reaction with benzenesulphonyl chloride.

7. Diazonium Salts

- **Formation:** Aromatic primary amines react with nitrous acid to form diazonium salts.
- **Reactions:**
 - **Substitution:** Replaced by Cl^- , Br^- , CN^- , OH^- , etc.
 - **Coupling Reaction:** Forms azo dyes by reaction with phenols or aromatic amines.
- **Importance:** Diazonium salts are intermediates for the synthesis of aromatic compounds, including halides, cyanides, phenols, and azo dyes.

8. Importance of Amines

- Amines are vital in the synthesis of drugs, polymers, and dyes.
- The basicity of amines depends on the nature of the alkyl/aryl groups attached to nitrogen.