Chapter 12

Amines

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GENERAL INTRODUCTION AND PHYSICAL PROPERTIES

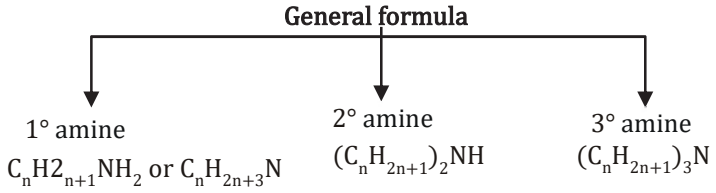
Introduction and Physical Properties of Amines

Introduction

"Amines are organic compounds characterized by the presence of the -NH_2 functional group, where a nitrogen atom possesses an unshared pair of electrons. These compounds are derived from ammonia, allowing for the substitution of one or more hydrogen atoms with substituent groups like alkyl or aryl. Notable examples of amines include amino acids, biogenic amines, trimethylamine, and aniline."

Classification of Amines

Amines can be categorized into four distinct groups: primary, secondary, tertiary, and cyclic. A primary amine is formed when one of the three hydrogen atoms is substituted with an alkyl or aryl group. In the case of replacing two out of the three hydrogen atoms, a secondary amine is generated, while tertiary amines are produced when all three hydrogen atoms are replaced. It's important to note that cyclic amines are typically secondary or tertiary in nature, and an example of such a cyclic amine is the 3-membered ring aziridine.



Physical Properties of Amines

- Lower aliphatic amines exhibit a gaseous state and carry a distinctive fishy odor.
- Primary amines containing three or four carbon atoms are in a liquid state at room temperature, while higher carbon chain primary amines tend to be solid.
- Arylamines like aniline are typically colorless, but they can develop coloration when exposed to the elements due to atmospheric oxidation.
- Lower aliphatic amines are capable of forming hydrogen bonds with water molecules, rendering them soluble in water. However, as the size of the hydrophobic alkyl portion increases and the molar mass of amines rises, their solubility in water diminishes, eventually rendering higher amines insoluble.

- Amines are readily soluble in organic solvents such as alcohol, benzene, and ether. Alcohols exhibit greater polarity compared to amines, resulting in the formation of stronger intermolecular hydrogen bonds.
- Primary and secondary amines often engage in intermolecular associations facilitated by hydrogen bonding between the nitrogen atom of one molecule and the hydrogen atom of another.
- In the case of primary amines, this intermolecular association is more pronounced compared to secondary amines due to the presence of two hydrogen atoms.
- Tertiary amines lack intermolecular association due to the absence of available hydrogen atoms for bonding.
- The boiling point order of amines is as follows:

Primary > Secondary > Tertiary.