

Physical properties of amines: →

1. It's lower members are gases (C_1 to C_9), onward or C_9 to C_{10} are liquids and onward C_{10} it becomes in solid state for aliphatic amines. Aniline is aromatic amine and it is in liquid state.
2. Aliphatic amines of C_1 to C_9 are gases & it has fishy smell.
3. Aniline is colourless but whenever it is oxidised it becomes coloured. Generally aryl amines are colourless whenever closed in container.
4. Lower aliphatic primary amines or may be secondary amines are soluble in water because it can form hydrogen bond with water. In case of tertiary amines there is no hydrogen directly bonded with Nitrogen so it can not form hydrogen bond with water hence it is insoluble in H_2O . As molecular mass increases or size of alkyl (R) group increases the solubility of amine (any degree) in water decreases because R is hydrophobic in nature so it decreases the tendency to form hydrogen bond with water.
5. In alcohol 'O' is present in functional group but in amine 'N' is present in functional group, the electronegativity of 'O' is more than 'N' so the hydrogen

bond formed by oxygen is stronger than ~~the~~ Nitrogen ~~hence~~ Hydrogen bond formed by alcohol is stronger than amine, and hence if comparable molecular mass of 1° Alcohol & 1° amine is given for comparative study for the solubility in water, then no doubt 1° Alcohol will be more soluble than 1° amine having comparable molecular mass. Alcohols are more polar than amines.

5. Intermolecular association among amine molecules are more in primary amines than secondary amines, but not possible in tertiary amines. Hence the boiling point in primary (1°) amine > Secondary (2°) amine > tertiary (3°) amines.

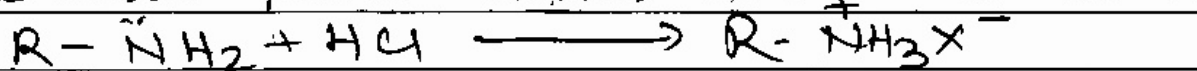
So boiling point of 1° Amine > 2° Amine > 3° Amine

Chemical properties :-

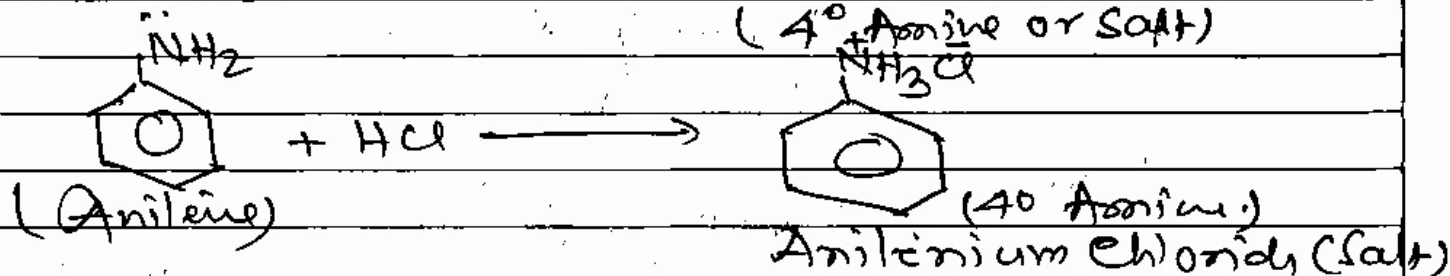
Amine of any degree either 1° or 2° or 3° contains lone pair of electron on nitrogen atom. So according to Lewis it is electron pair donor and it behaves as Lewis base.

Basic character of amines: →

- 1) Reaction with acid (Hydrochloric acid): →
 Due to presence of lone pair of electron on nitrogen atom, amine behave as Lewis base, so when it react with mineral acids like HCl it form salt. This reaction proves amines are + base in nature.

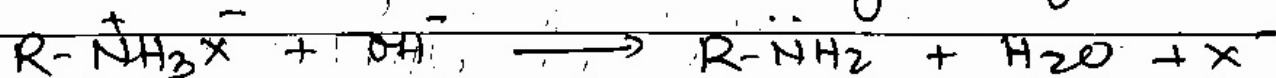


(4° Amine or salt)

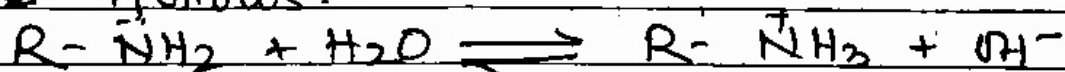


The formed 4° Amine or salt formed is soluble in water but insoluble in organic solvent like ether, carbon tetrachloride etc.

Amine salt on treatment with a base like NaOH, or KOH it again gives 1° Amine



We can explain the basic nature of amine by the help of K_b and pK_b also as follows: -



$$K = \frac{[R-\overset{+}{N}H_3][OH^-]}{[R-\ddot{N}H_2][H_2O]}$$

Where K = Equilibrium Constant.

Teacher's Signature : _____

$$\text{or } K \times [\text{H}_2\text{O}] = \frac{[\text{R}-\ddot{\text{N}}\text{H}_3] [\text{OH}^-]}{[\text{R}-\ddot{\text{N}}\text{H}_2]}$$

$$\text{or } K_b = \frac{[\text{R}-\ddot{\text{N}}\text{H}_3] [\text{OH}^-]}{[\text{R}-\ddot{\text{N}}\text{H}_2]}$$

$$\text{p}K_b = -\log_{10} K_b$$

$$\text{or } \text{p}K_b = \log_{10} \frac{1}{K_b}$$

$K_b \propto$ strength of base

$\text{p}K_b \propto \frac{1}{\text{Strength of base}}$

$\text{p}K_b$ value of $\ddot{\text{N}}\text{H}_3$ is 4.75 but the $\text{p}K_b$ value of methanamine is 3.38, and ethanamine is 3.29.

So Basic strength of ethanamine > methanamine > ammonia

Note: Aliphatic amines are stronger bases than ammonia due to +I effect (presence of R group) or due to e donating nature of alkyl (R) group, whereas aryl amines are weaker base than ammonia due to electron withdrawing nature of aryl group.

