Amines Class 12 Key Points

CBSE Class 12 Chemistry · NCERT · for boards, NEET and JEE revision

ChapterNotes

What Amines Are

1°: $R–NH_2$ · 2°: R_2NH · 3°: R_3N

N is sp^3, pyramidal, with a lone pair that drives basicity & nucleophilicity.

- Class = how many CARBONS attach to N (not the carbon type)
- tert-butylamine & benzylamine are 1° - only one C on N
- The lone pair is the engine of every reaction in this chapter

Nomenclature

CH_3NH_2 → methanamine · $C_6H_5NH_2$ → aniline

Common names list groups + 'amine' as one word (e.g. ethylmethylamine).

- $(CH_3)_2CH–NH_2$ → propan-2-amine (1°)
- $C_2H_5–NH–CH_3$ → N-methylethanamine
- Aniline = aminobenzene = benzenamine (fixed name)

Preparing Amines

$R–NO_2$ →(Sn/HCl or H_2/Ni) $R–NH_2$

Ammonolysis (R–X + NH_3) is non-selective → gives a 1°/2°/3°/quaternary mixture.

- Nitrile $R–C\equiv N$ →(H_2/Ni) $R–CH_2–NH_2$ - GAINS one carbon
- Amide →($LiAlH_4$) amine - SAME carbon count
- $NaNO_2$/HCl is diazotisation, NOT reduction - don't confuse

Gabriel vs Hoffmann

$R–CONH_2$ →(Br_2/KOH) $R–NH_2$ (one C fewer)

Hoffmann expels the carbonyl carbon as carbonate → amine has ONE C less than the amide.

- Gabriel → pure 1° amine; FAILS for aryl amines (no SN2 on aryl halides)
- Hoffmann bromamide → loses one carbon
- Propanamide (3C) →Hoffmann→ ethanamine (2C)

Boiling Point & Solubility

1° amine > 2° amine > 3° amine (similar molar mass)

3° amines boil lowest - no N–H to donate, not because they're less polar.

- Across families: alcohol > amine > ether ≈ alkane (O more electronegative than N)
- 3° amines still dissolve in water - lone pair accepts H-bond (N···H–O)
- Solubility falls as the carbon chain grows; lower amines smell fishy

Basicity in Water

$(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$

Lower pK_b (higher K_b) = stronger base. Gas-phase order is the regular 3°>2°>1°>NH_3.

- +I effect of alkyl groups makes aliphatic amines stronger than NH_3
- 3° drops below 1° in water: poor solvation + steric crowding
- Aryl > don't apply +I here - see the next card

Why Aniline Is Weak

aliphatic amine > NH_3 > aniline

Weakness is from resonance delocalisation, not any inductive effect.

- Electron-withdrawing $–NO_2$ on the ring → even weaker base
- Electron-donating $–CH_3$ / $–OCH_3$ → stronger base
- p-nitroaniline ≪ aniline < p-toluidine

Identifying the Class

$R–NH_2 + CHCl_3 + 3KOH(alc.) \rightarrow R–NC$ (foul isocyanide)

Carbylamine test is POSITIVE for 1° amines only; needs ALCOHOLIC KOH.

- Hinsberg ($C_6H_5SO_2Cl$): 1° → soluble in KOH, 2° → insoluble, 3° → no reaction
- 3° amines can't be acylated (no N–H) and give no carbylamine test
- 1° & 2° amines acylate with acid chlorides/anhydrides → amides

Reactions of Aniline

aniline + Br_2 water → 2,4,6-tribromoaniline (instant ppt)

To stop at mono-substitution, acetylate first ($–NH_2$ → $–NHCOCH_3$), then hydrolyse.

- 1° aromatic amine + HNO_2 at 0-5 °C → stable diazonium salt
- 1° aliphatic amine + HNO_2 → alcohol + brisk N_2 gas
- Acetylation also protects N from oxidation

Diazonium Salts

$C_6H_5NH_2$ →($NaNO_2$/HCl, 273-278K) $C_6H_5N_2^+Cl^-$

Cold (0-5 °C) is non-negotiable; warming gives phenol + N_2. Only ARYL salts are usable.

- Sandmeyer: –Cl/–Br (CuCl/CuBr), –CN (CuCN); –I needs only KI (no Cu)
- –F via Balz–Schiemann (HBF_4, heat); –OH via warm water; –H via H_3PO_2
- Coupling with phenol/aniline → azo dye (–N=N–) at para position

Quick revision

- Amines: 1° (RNH_2), 2° (R_2NH), 3° (R_3N)
- Gabriel synthesis: only 1° amines, not aromatic amines
- Hofmann degradation: amide → amine (1 less C)
- Basicity (aq): ethyl series 2° > 3° > 1° > NH_3; methyl series 2° > 1° > 3° > NH_3; aniline is far weaker
- Aniline weak base: lone pair delocalised into ring
- Carbylamine test: 1° amines only → foul smell of isocyanide
- Hinsberg: 1° dissolves in NaOH, 2° doesn't, 3° no reaction
- Diazonium salt: $ArNH_2$ + $NaNO_2$ + HCl at 0-5°C
- Sandmeyer: ArN_2^+ + CuX/HX → ArX (Cl, Br, CN)
- Coupling: diazonium + phenol/amine → azo dye

Full chapter notes with solved examples and practice questions: https://chapternotes.in/cbse/class-12-chemistry/amines-class-12-notes/