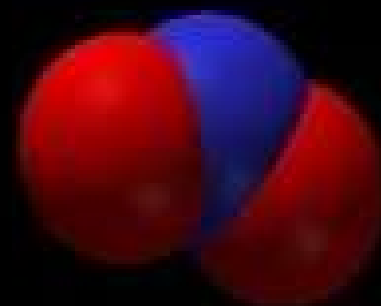
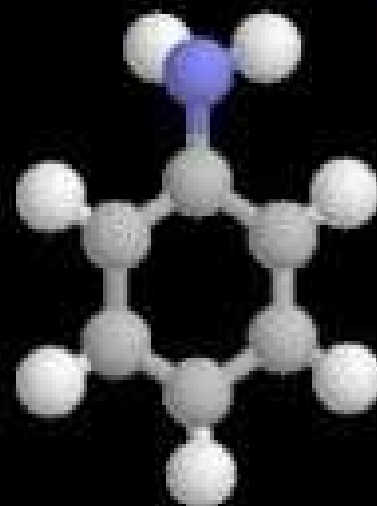
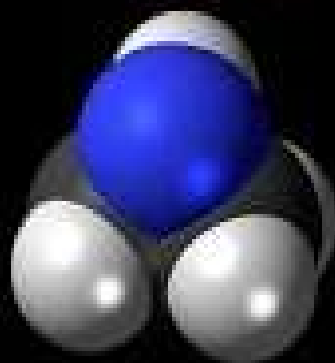


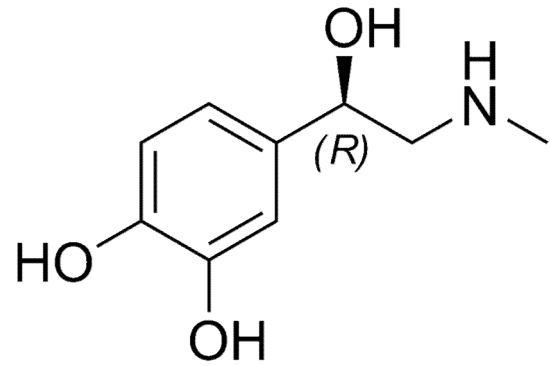
NITROGEN DERIVATIVES

(AMINES)

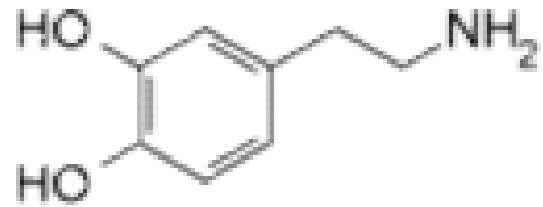
Part
One



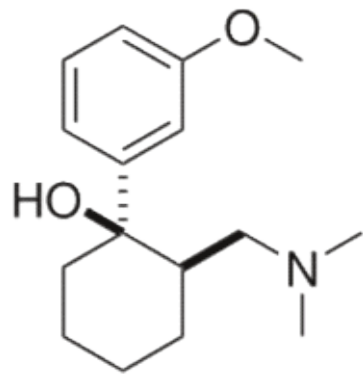
Dr. Munther Abdujaleel M.A.
Assist. Prof. Org. Chem.



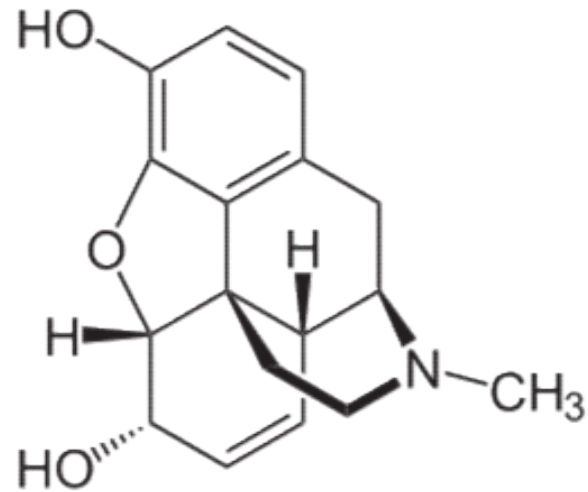
Adernalin
Hormone



Dopamine



Tramadol

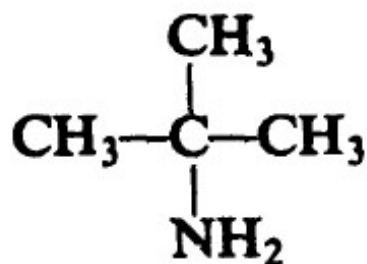


Morphin

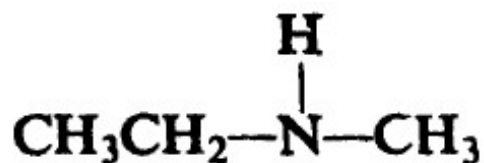
Nomenclature

Common Name

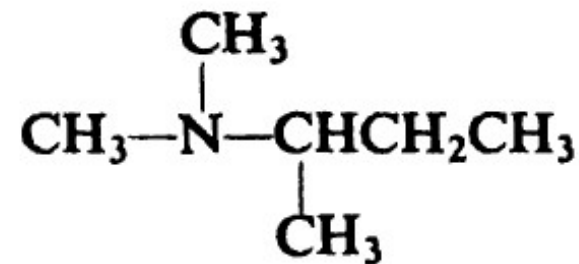
- ❖ Aliphatic amines are named by naming the alkyl group or groups attached to nitrogen, and following these by the word **-amine**.



tert-Butylamine
(1°)



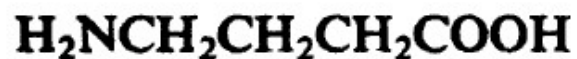
Methylethylamine
(2°)



Dimethyl-*sec*-butylamine
(3°)

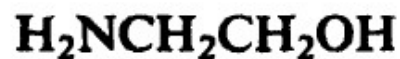
IUPAC Name

- ❖ prefixing amino- (or N-methylamina-, N,N-diethylamino-, etc.) to the name of the parent chain.



γ-Aminobutyric acid

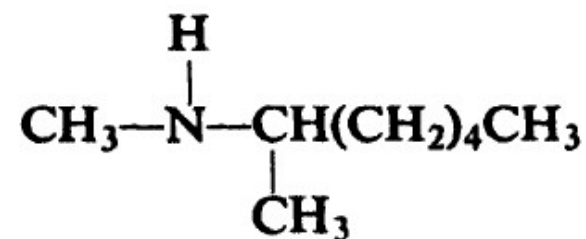
(1°)



2-Aminoethanol

(Ethanolamine)

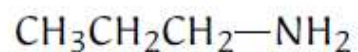
(1°)



2-(N-Methylamino)heptane

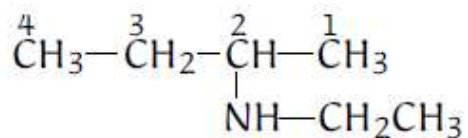
(2°)

EX 's



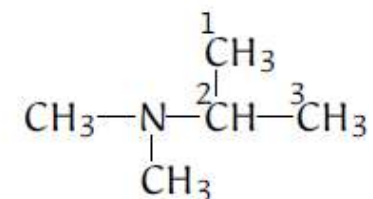
1-aminopropane

propylamine



2-(N-methylamino)butane

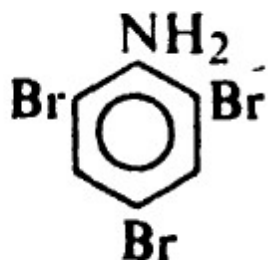
sec-butylethylamine



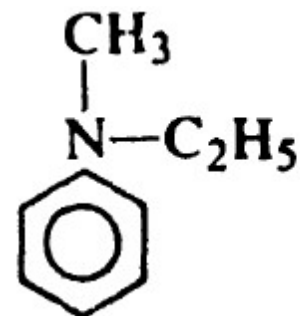
2-(N,N-dimethylamino)propane

isopropyldimethylamine

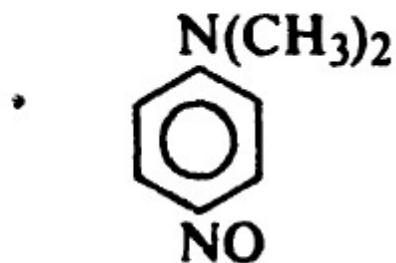
- ❖ **Aromatic amines** are generally named as derivatives of the simplest aromatic amine, **aniline**.



2,4,6-Tribromoaniline
(1°)



N-Methyl-N-ethylaniline
(3°)

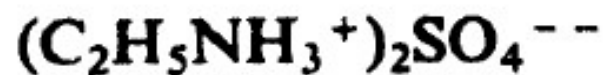


***p*-Nitroso-N,N-dimethylaniline**
(3°)



***p*-Toluidine**
(1°)

❖ Salts of amines are generally named by replacing **-amine** by **-ammonium** (or **-aniline** by **-anilinium**), and adding the name of the anion (chloride, nitrate, sulfate, etc.).



Ethylammonium
sulfate



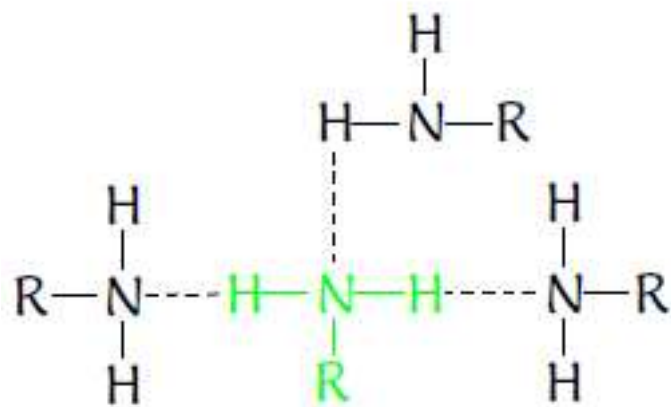
Trimethylammonium
nitrate



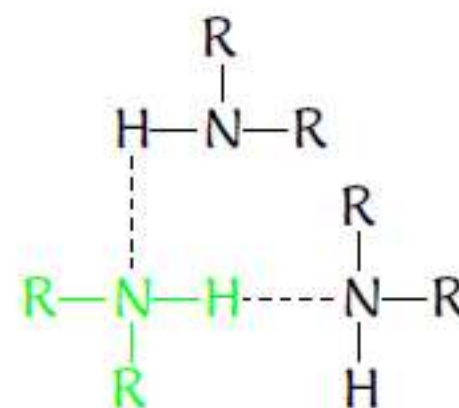
Anilinium
chloride

Physical properties of amines

- ❖ Amines are polar compounds and, except for tertiary amines, can form intermolecular H. B.



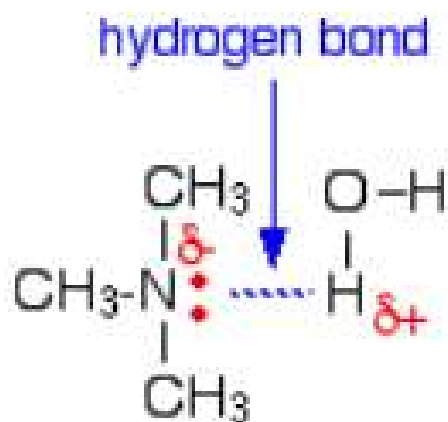
1° amines



2° amines

- ❖ Amines have higher b. p. than non-polar compounds of the same molecular weight, but lower b. p. than alcohols or carboxylic acids.

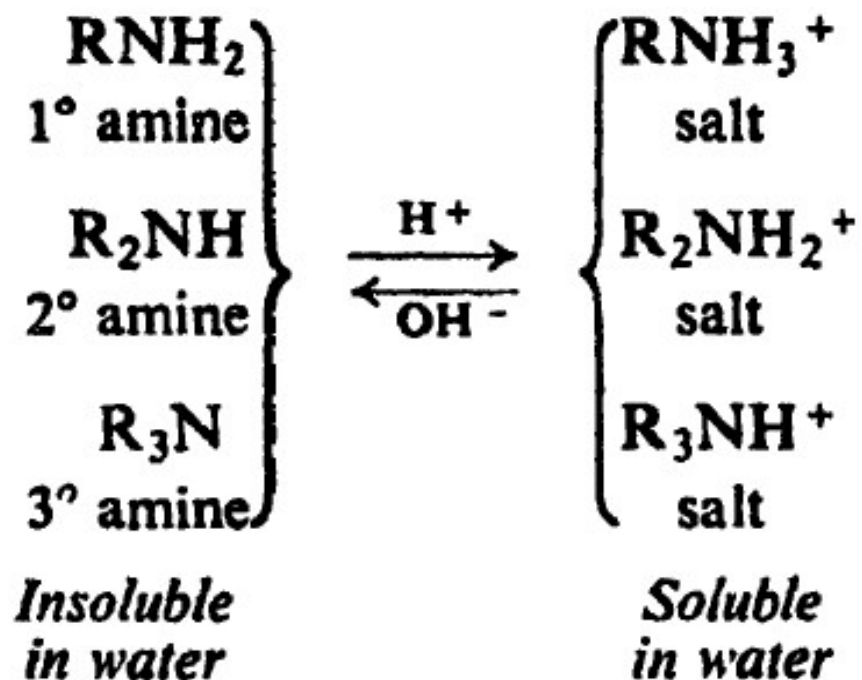
- ❖ Amines of all three classes (1°, 2° and 3°) are capable of forming hydrogen bonds with water. As a result, smaller amines are quite soluble in water



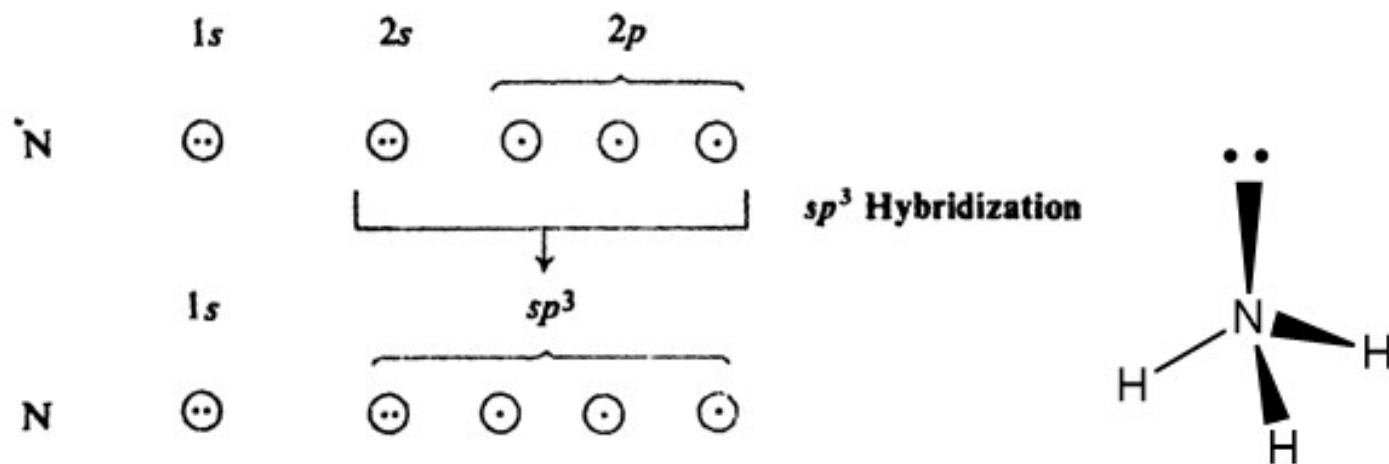
- ❖ Aromatic amines are generally very toxic; they are readily absorbed through the skin, often with fatal results.
- ❖ Aromatic amines are very easily oxidized by air, and although most are colorless when pure.

Salts of amines

- Aliphatic amines are about as basic as ammonia; aromatic amines are considerably less basic. WHY?
- The basicity is ranked as following:
Hydroxide ion (OH^-) or ethoxide ion (EtO^-) \gg amines \gg alcohols, ethers and esters \gg water
- **Aqueous mineral acids** or carboxylic acids readily convert amines into their **salts**; **aqueous hydroxide ion** readily converts the salts back into the **free amines**.

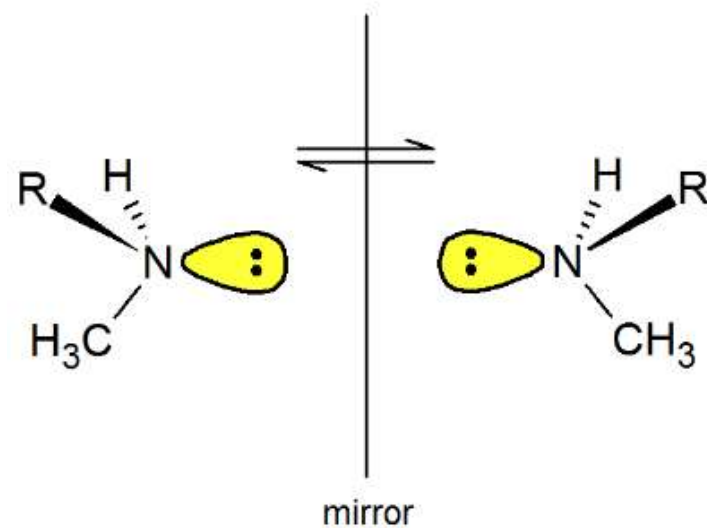


Stereochemistry of nitrogen



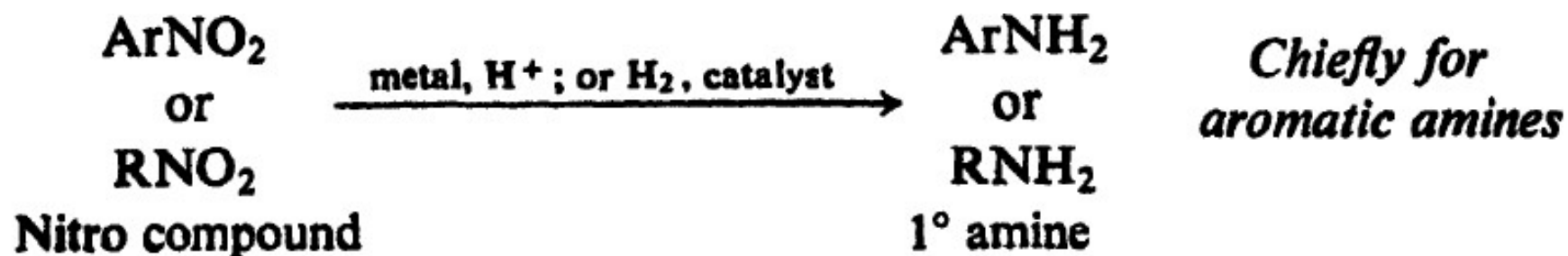
sp^3 hybridization (Tetrahedral)

If N carries three different groups, it is chiral and exist in two enantiomeric forms I and II.

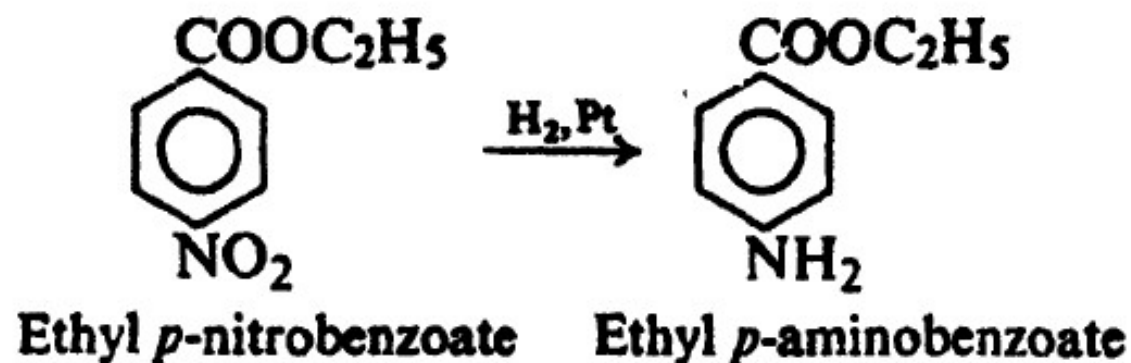


Preparation of amines

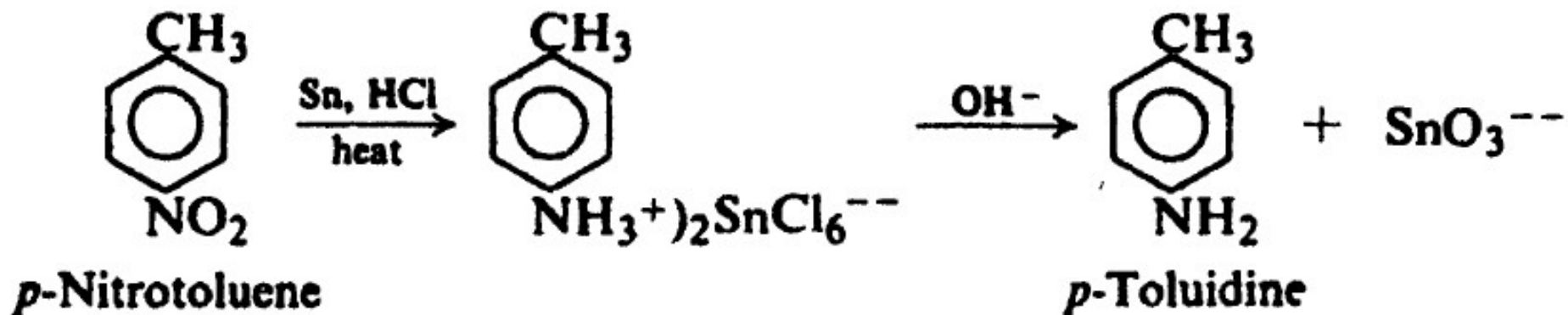
1. Reduction of nitro compounds.



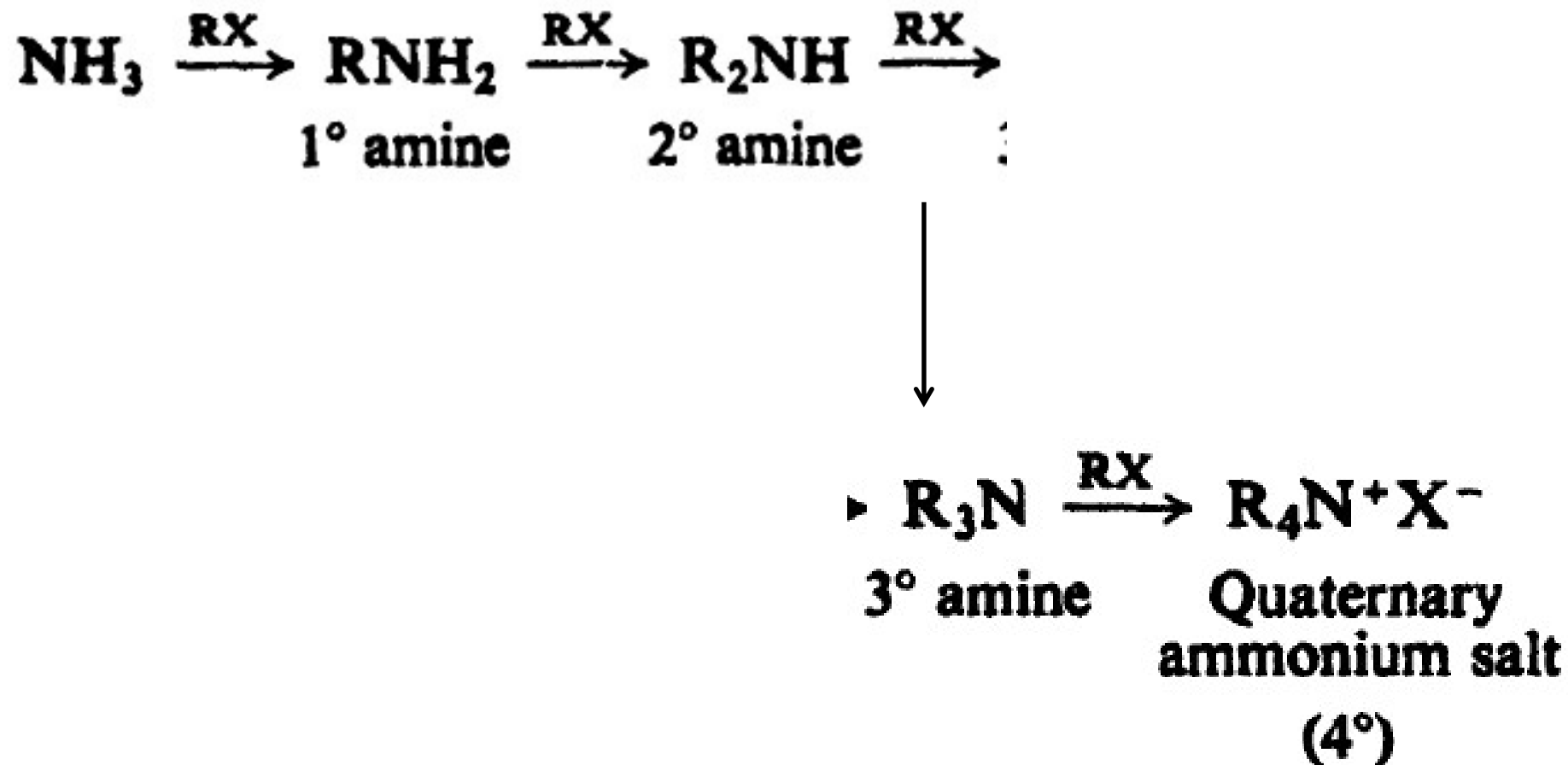
Examples:



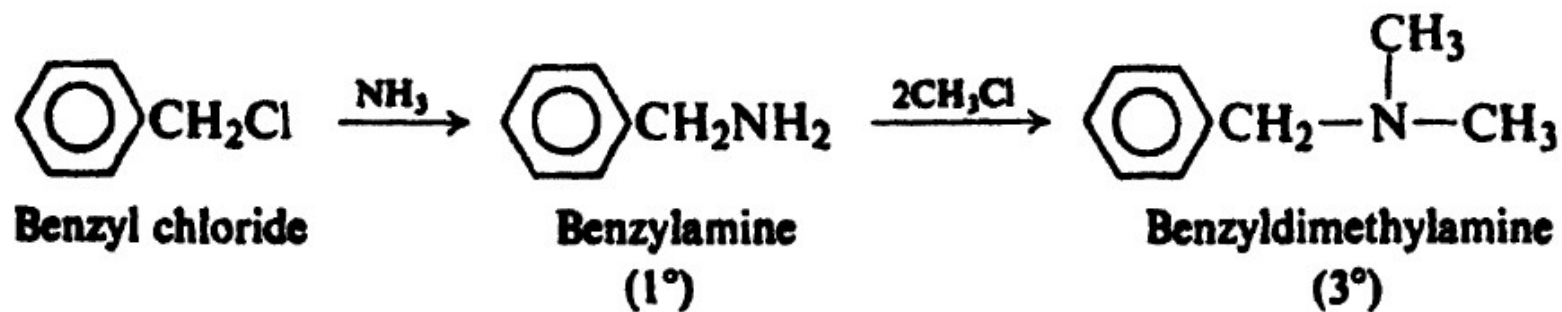
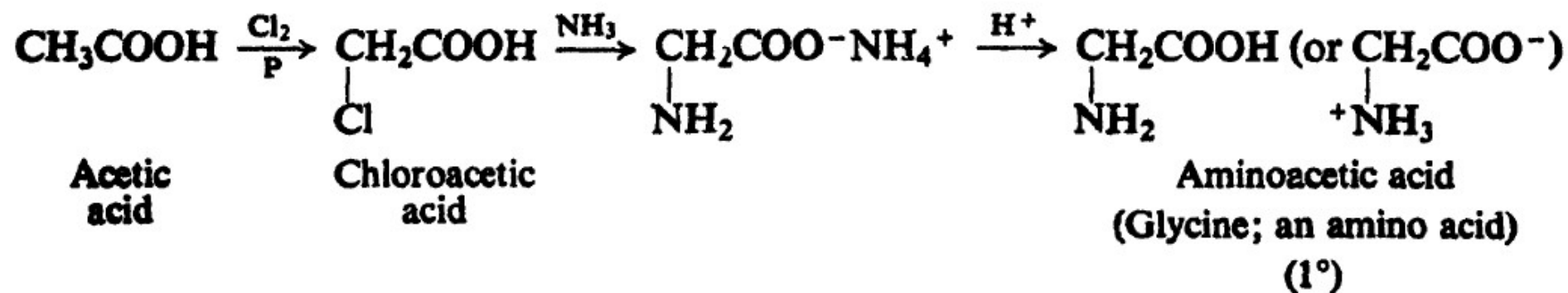
In the acidic solution, the amine is obtained as its salt; the free amine is liberated by the addition of base.



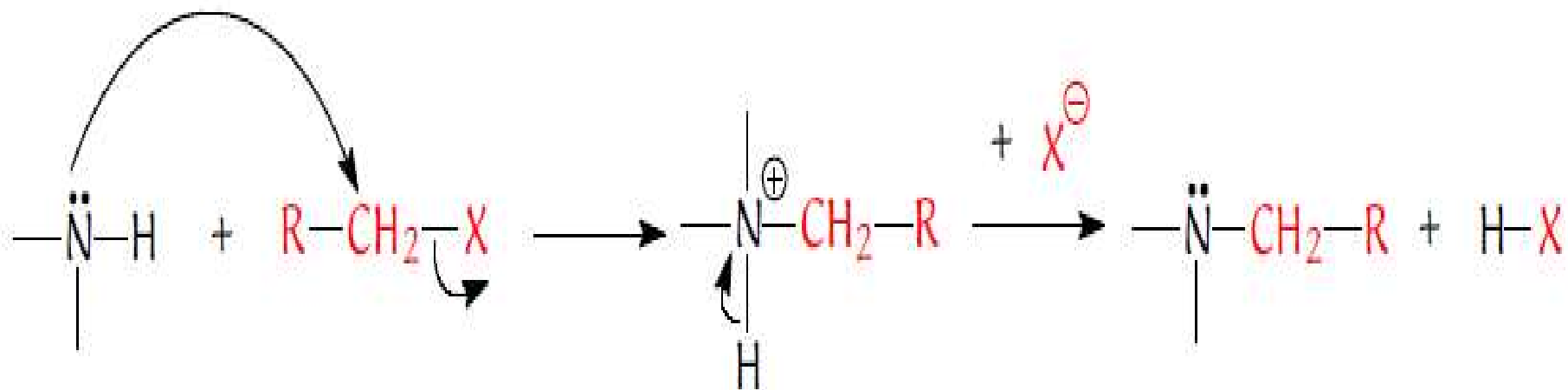
2. Reaction of halides with ammonia or amines (ammonolysis of halides)



Examples:

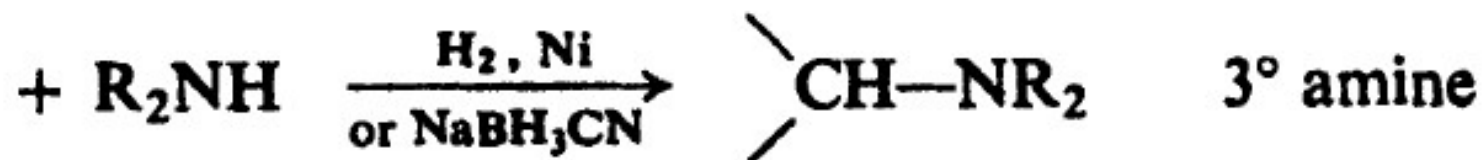
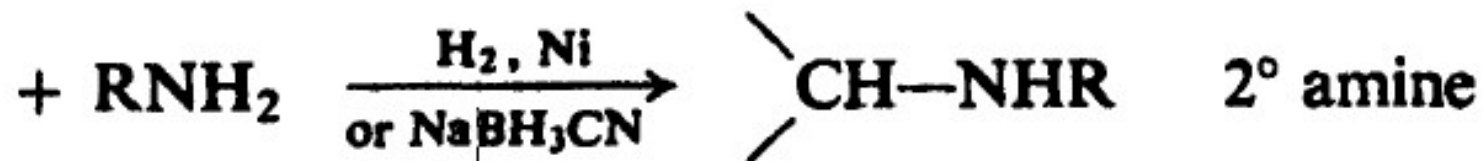


Ammonolysis of halides belongs to the class of reactions that we have called **nucleophilic substitution**. The organic halide is attacked by the **nucleophilic ammonia** molecule

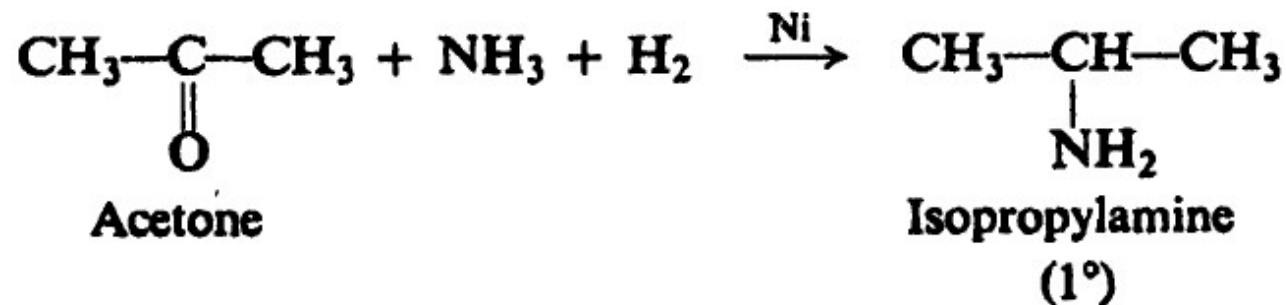


3. Reductive amination.

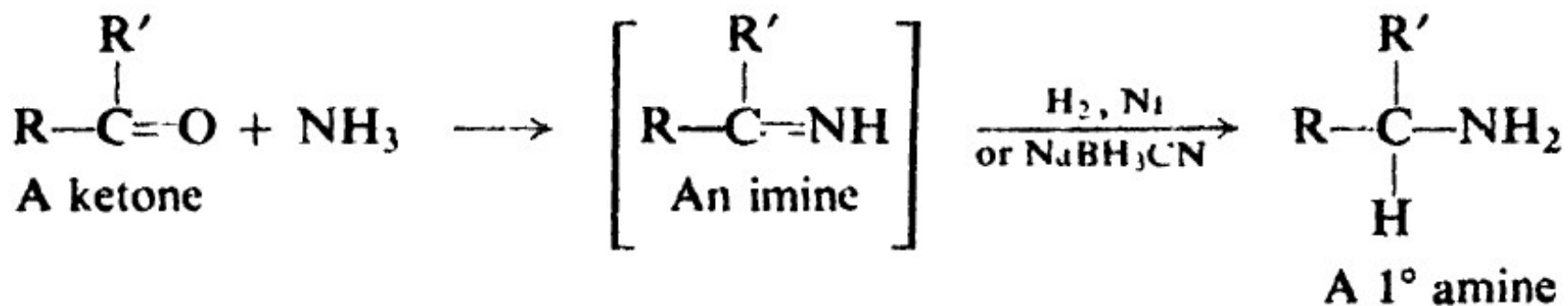
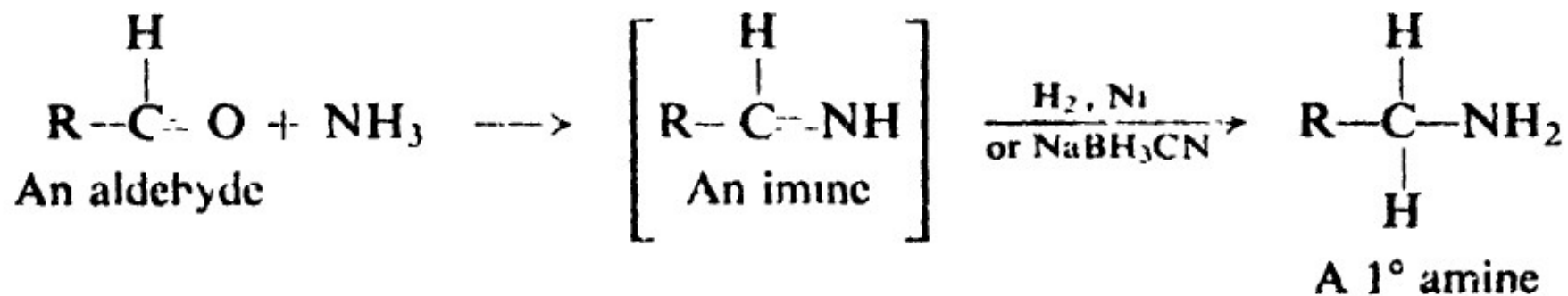
Reduction of aldehydes RCHO and ketones R₂CO in the presence of ammonia or amine.



Examples:



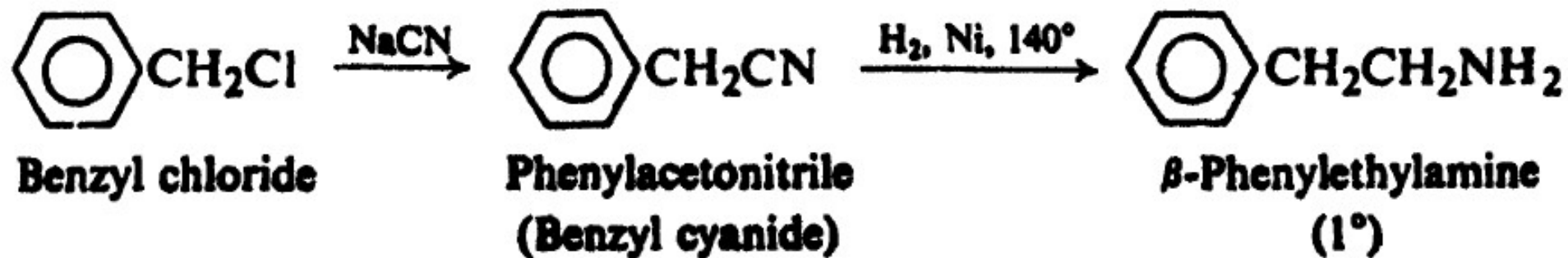
Reaction involves **reduction** of an intermediate compound (an **imine**, $RCH=NH$ or $R_2C=NH$) that contains a carbon-nitrogen double bond, which then undergoes reduction process by **sodium cyanohydridoborate** to form amine compound.



4. Reduction of nitriles.

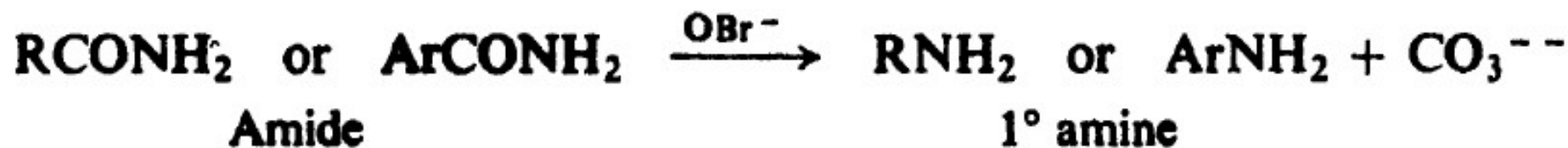


Example

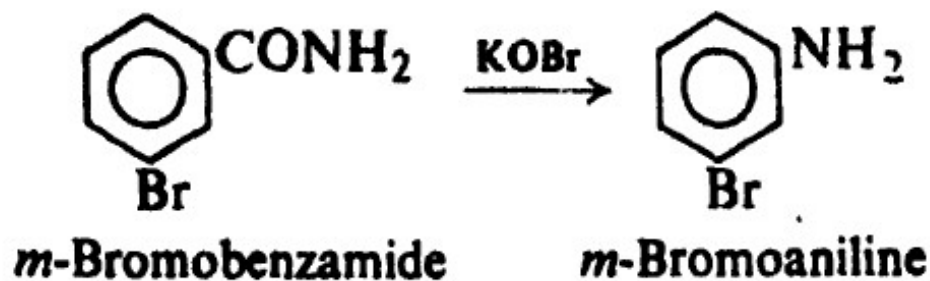
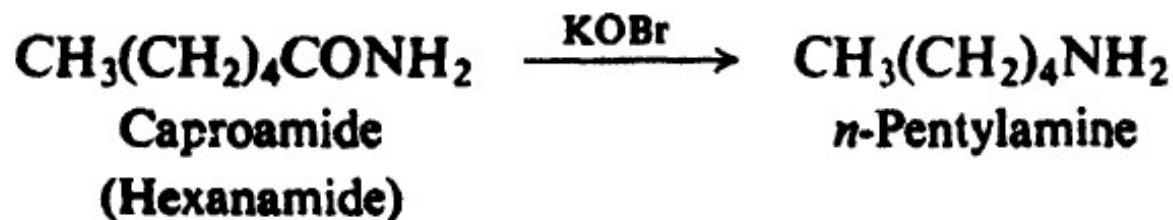


Synthesis via **reduction of nitriles** has the special feature of *increasing the length of a carbon chain*, producing a primary amine that has one more carbon atom than the alkyl halide from which the nitrile was made.

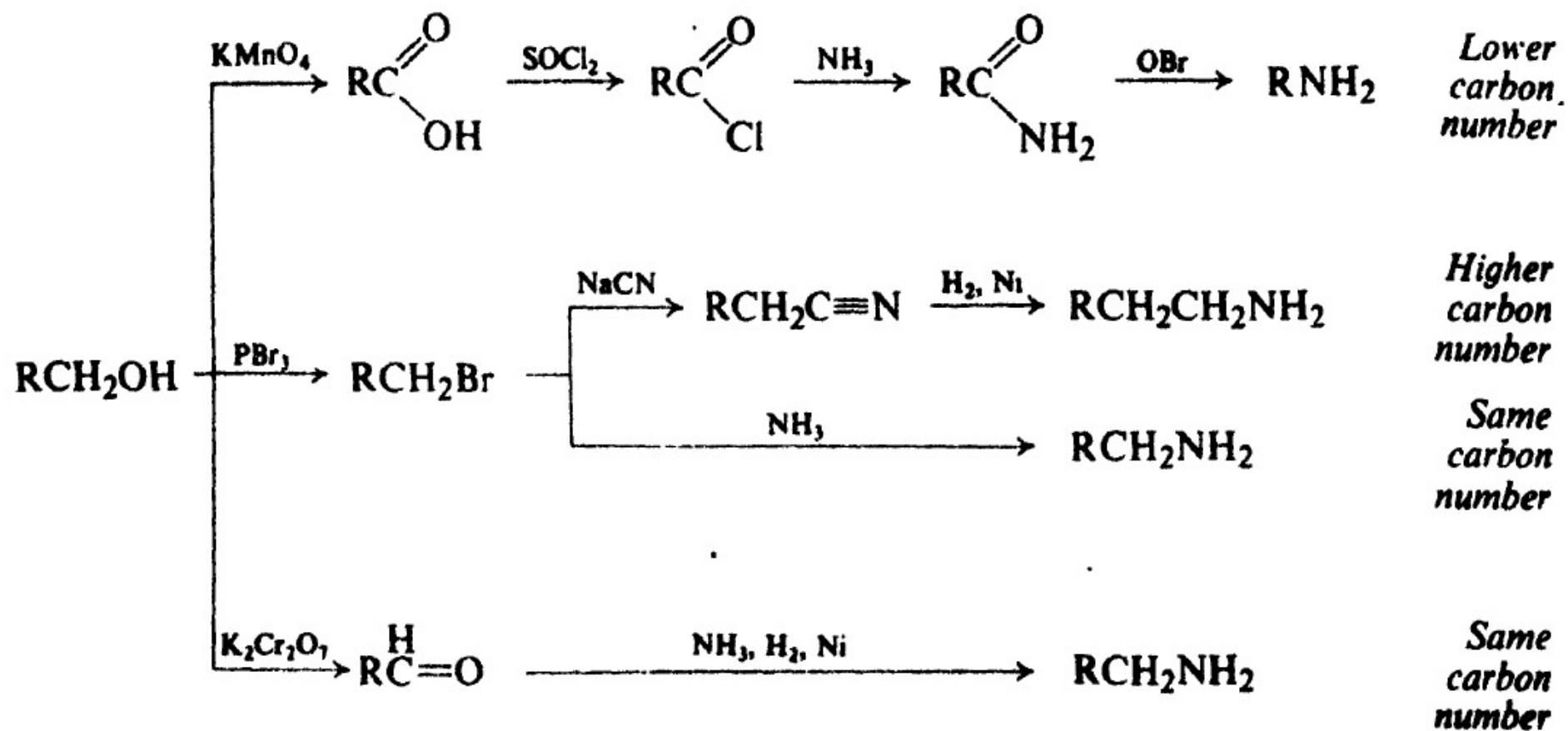
5. Hofmann degradation of amides using potassium hypobromite KOBBr.



Examples:

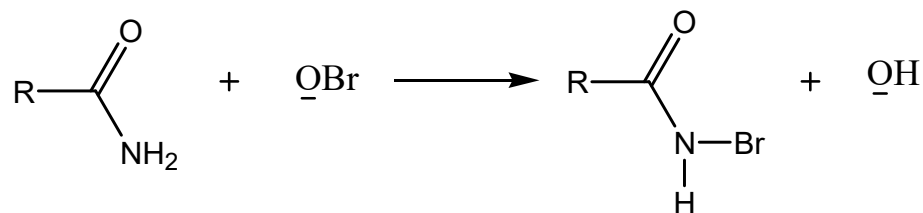


The **Hofmann degradation** of amides has the feature of *decreasing the length of a carbon chain* by one carbon atom; it is also of interest as an example of an important class of reactions involving rearrangement.

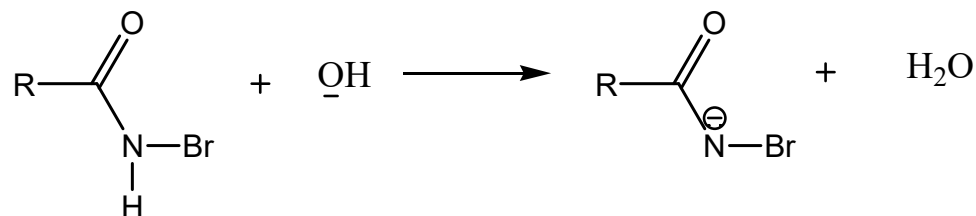


The mechanism of Hofmann degradation includes the following steps:

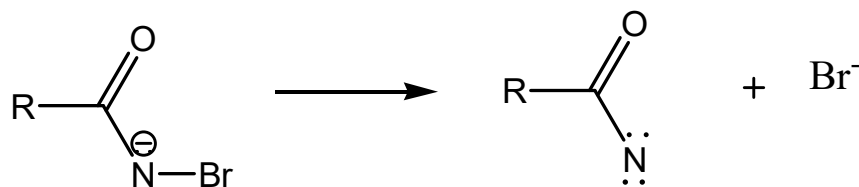
1- Halogenation of an amide to yield N-haloamide.



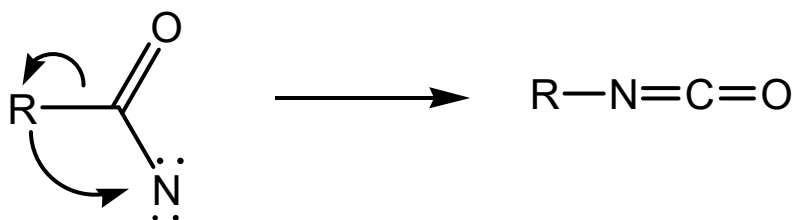
2- Abstraction of a hydrogen ion by OH⁻ to give unstable salt.



3- Separation of a halide ion, which leaves behind electron-deficient nitrogen atom.



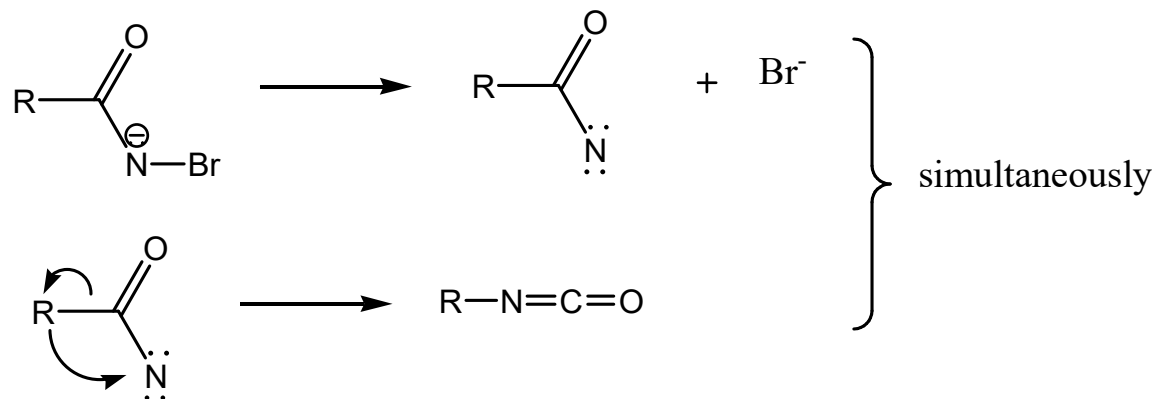
4- Rearrangement occurs to yield isocyanate compound.



5- Hydrolysis of an isocyanate to form an amine and carbonate ion.



The steps 3 and 4 occur simultaneously.



Synthesis of secondary and tertiary amines

Secondary and tertiary amines are prepared by adaptations of one of the **ammonolysis of halides** or **reductive amination** processes.

