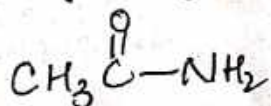


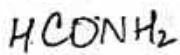
Amides (R-C(=O)-NH₂)

They are derivatives of acids in which -OH part of the -COOH group is replaced by -NH₂ -NHR or NR₂ groups

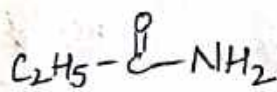
They are further classified as primary, secondary, tertiary.



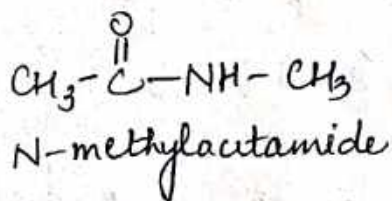
Acetamide
or
Ethanamide



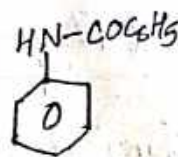
Formamide
or
Methanamide



Propionamide



Benzamide

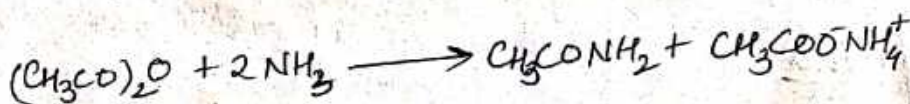


Benzanilide

Preparation

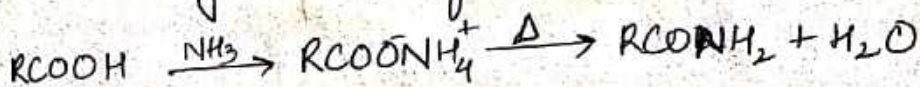
1) Ammonolysis of acid derivatives:

Acid amides can be prepared by action of conc. NH₃ or amines on acid chlorides, anhydrides or esters.



2) Thermal decomposition of ammonium salts:

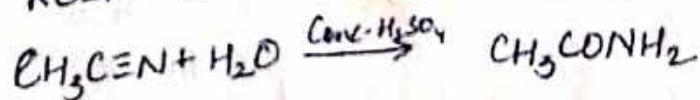
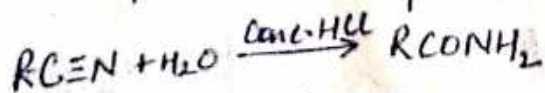
Ammonium salts of carboxylic acids when heated undergo dehydration to form amides



Since dehydration of ammonium salts occurs at relatively high temperatures therefore, this method is not useful for laboratory preparation of amides.

3) Partial hydrolysis of alkyl cyanides

Acid amide may be prepared by partial hydrolysis of alkyl cyanides. This may be carried out by shaking the alkyl cyanide with conc. HCl or by dissolving the alkyl cyanide in conc. H_2SO_4 and then pour it into water



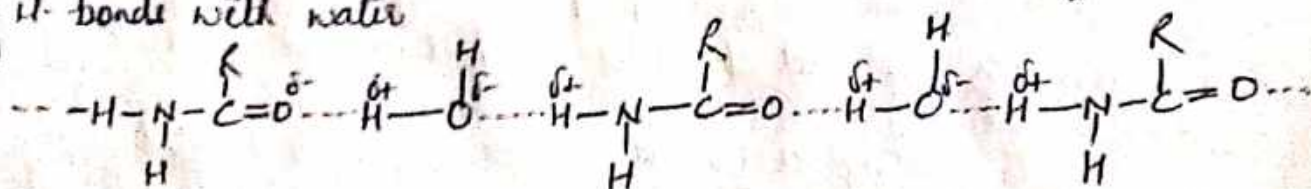
Physical Properties

1) Physical State

Formamide is a liquid while all other acid amides are colorless crystalline solids at room temperature.

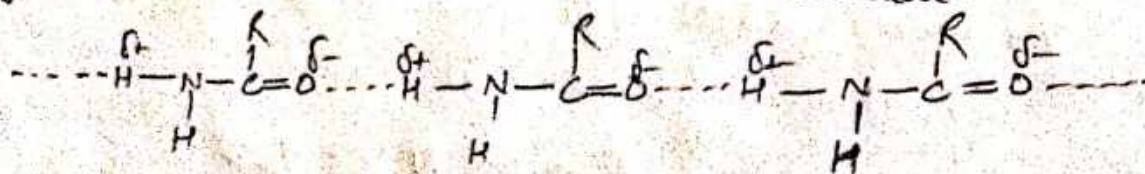
2) Solubility

The lower amides (upto C_6) are soluble in water due to formation of H-bonds with water



3) Boiling Points

Amides have high melting points and boiling points due to strong intermolecular hydrogen bonding. As a result, their boiling points are even higher than the acids from which they are derived even though their molecular mass are almost identical.



Chemical Properties

Acid amides are least reactive of all acids derivatives towards nucleophilic acyl substitution.

Acid amides can behave both as weak acids and weak bases.

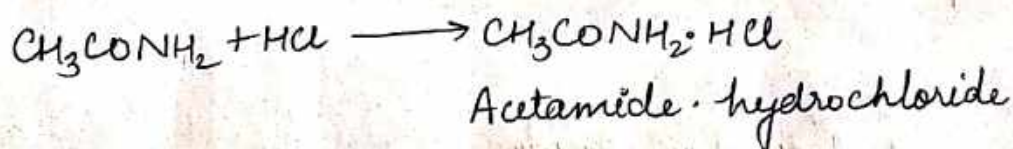
Therefore these are amphoteric in character. Like amines they may be expected to be basic in character due to the presence of lone pair of electrons on Nitrogen atom.

But this lone pair of electrons is not readily available for protonation since it is involved in resonance

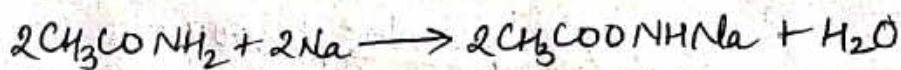


As a result, acid amides are much weaker bases than amines

Thus acid amides form salts only with strong inorganic acids



On account of resonance the nitrogen gets positively charged. As a result, it can easily lose a proton from nitrogen and hence behave as a weak acid



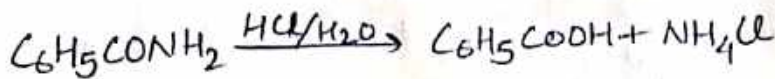
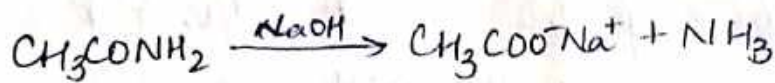
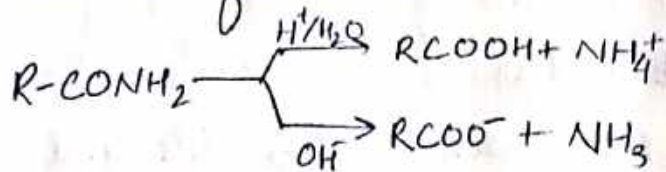
Acid amides liberate H_2 when treated with strong bases such as sodium metal or sodium hydride.

Reactions

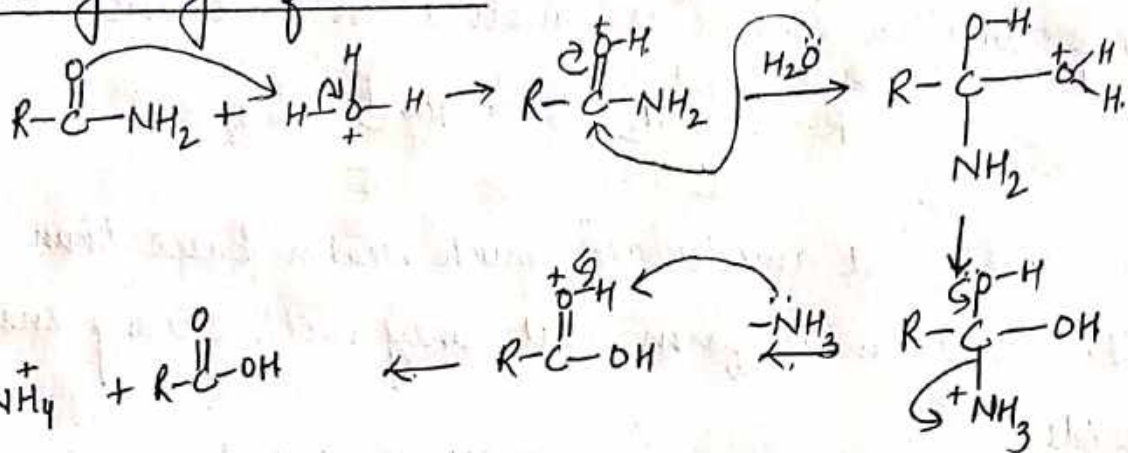
① Hydrolysis

Amides are hydrolysed slowly by water, rapidly by acids and more rapidly by alkalis. In acidic solution, the products are Carboxylic acid and ammonium salt

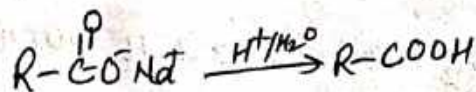
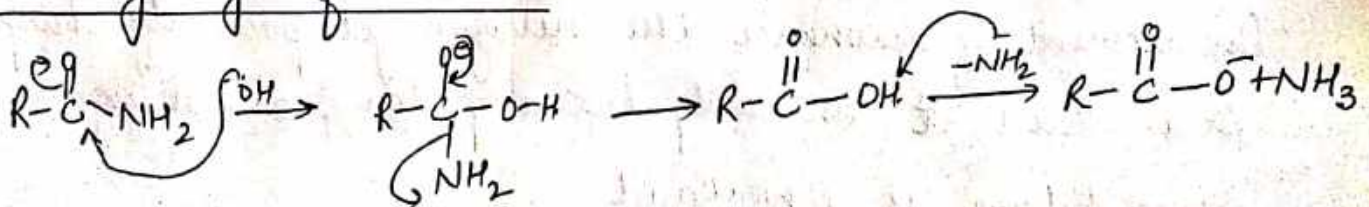
While in the alkaline solution, the products are salt of a Carboxylic acid and free ammonia



Acidic hydrolysis of an Amide

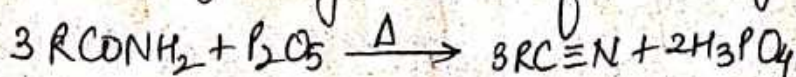


Basic hydrolysis of an Amide



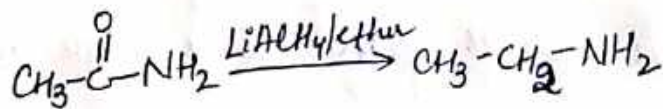
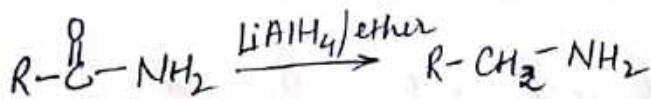
Dehydration

On heating with dehydrating agents such as P_2O_5 , POCl_3 , SOCl_2 amides undergo dehydration to form alkyl cyanides.



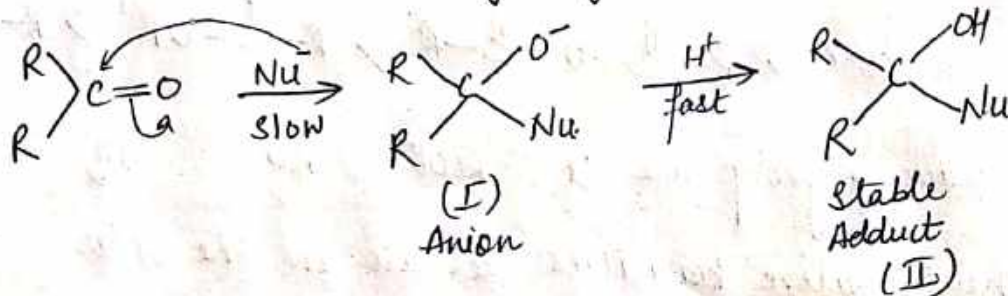
Reduction

Amides are reduced to the corresponding amines with LiAlH_4

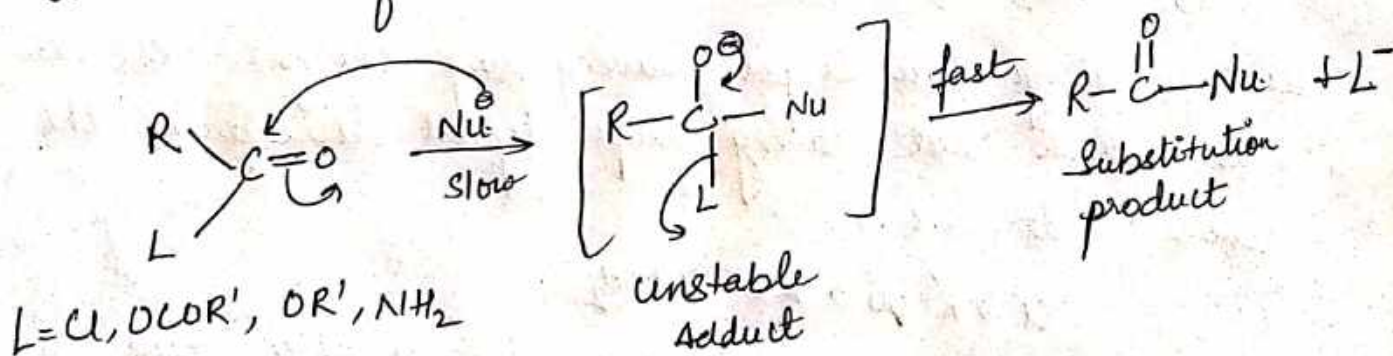


Nucleophilic Addition versus Nucleophilic Acyl Substitution

Aldehyde and ketones undergo nucleophilic addition reactions while all acid derivatives undergo acyl substitution



Stable adduct is formed



In acyl derivatives addition of the nucleophile to the carbonyl group gives an unstable adduct which readily loses the leaving group to give substitution product.

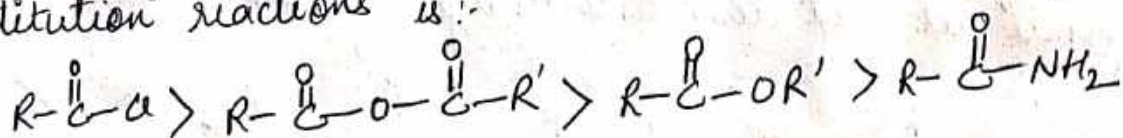
In case of aldehydes, the leaving group is either an hydride (H^-) or Carbanion (R^-), both are very strong bases and poor leaving groups therefore and hence do not depart easily.

In case of acyl derivatives leaving groups are Cl^- , RO^- , RCOO^- , NH_2^- . All these anions are must weaker bases than hydride ion and

Carbanions, therefore, the initially formed adduct readily loses leaving group to give substitution product.

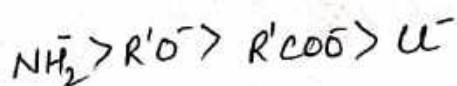
Thus aldehydes and ketones undergo nucleophilic addition reactions but acyl derivatives prefer to undergo nucleophilic substitution reactions

* The order of acyl derivatives towards nucleophilic acyl substitution reactions is:-

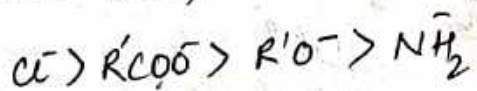


Here leaving groups are Cl^- , RCO_2^- , $R'O^-$, NH_2^-

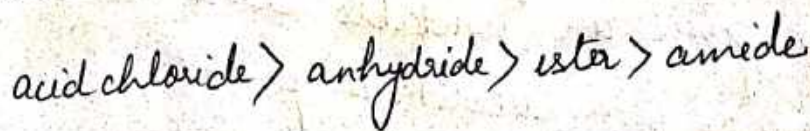
Their relative basicities decrease in the order



Since a stronger base is poor leaving group, therefore, the ease with which these leaving groups depart decrease in the reverse order i.e.,

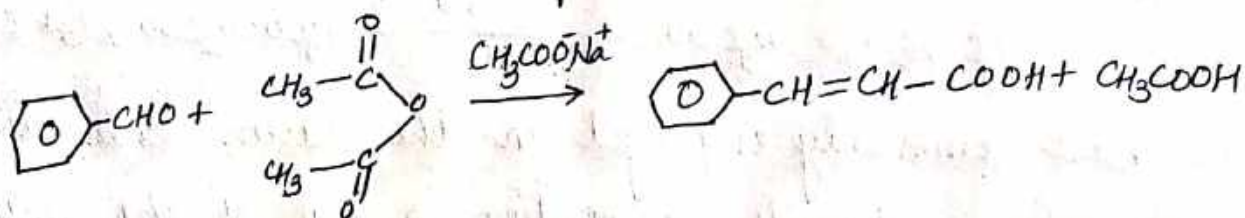


Consequently, the relative reactivities of all these acid derivatives decrease in the order:



Perkin Condensation

Aromatic aldehydes on reaction with aliphatic acid anhydride containing two α -hydrogens in presence of Na salt of the acid of corresponding to anhydride to give an α, β unsaturated acid is known perkin condensation.



Mech

