

### Carboxylic Acids:

Carboxylic Acids	Common Names
HCOOH	Formic acid
CH <sub>3</sub> COOH	Acetic acid
CH <sub>3</sub> -CH <sub>2</sub> -COOH	Propionic acid
CH <sub>3</sub> (CH <sub>2</sub> )COOH	Butyric acid
CH <sub>3</sub> (CH <sub>2</sub> ) <sub>3</sub> COOH	Valeric acid
CH <sub>3</sub> (CH <sub>2</sub> ) <sub>14</sub> COOH	Palmitic acid
CH <sub>3</sub> (CH <sub>2</sub> ) <sub>16</sub> COOH	Stearic Acid

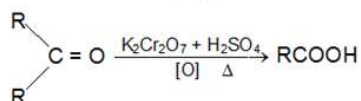
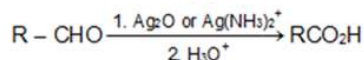
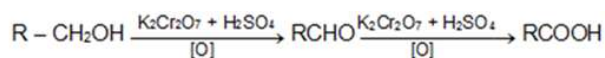
### Physical Properties of Carboxylic Acids

- The first three acids are colourless, pungent smelling liquids.
- First four members are miscible in water due to the intermolecular hydrogen bonding whereas higher members are miscible in non-polar solvents like ether.
- Benzene or ethanol but immiscible in water due to the increase in the size of lyophobic alkyl chain.
- The b.p. of carboxylic acids are higher than alcohols because carboxylic acids exist as dimers due to the presence of intermolecular H-bonding

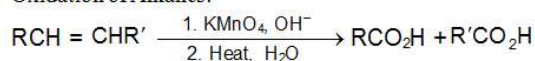
Increase in the number of Halogen atoms on  $\alpha$ -position increases the acidity, eg.  
CCl<sub>3</sub>COOH > CHCl<sub>2</sub>COOH > CClHCOOH > CH<sub>3</sub>COOH

## Methods of Preparations of Carboxylic Acids

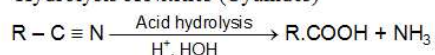
### a. Oxidation of Aldehydes & Ketones



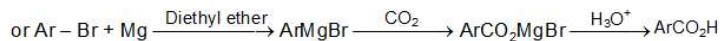
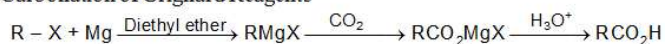
### b. Oxidation of Alkanes:



### c. Hydrolysis of Nitriles (Cyanides)

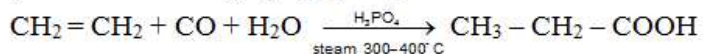


### d. Carbonation of Grignard Reagents

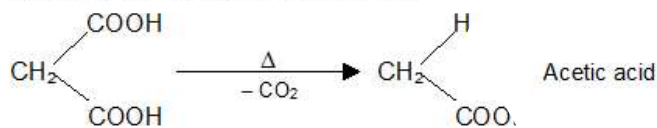


### e. Koch Reaction:

An olefin is heated with carbon monoxide and steam under pressure at 300-400° in the presence of a catalyst, e.g. phosphoric acid.

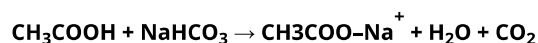
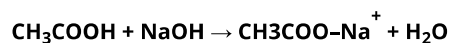
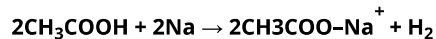


### f. Heating Gem Dicarboxylic Acids:

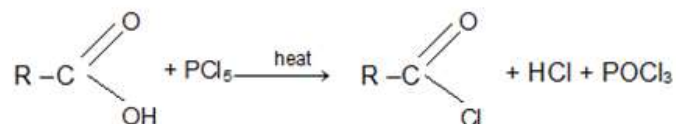
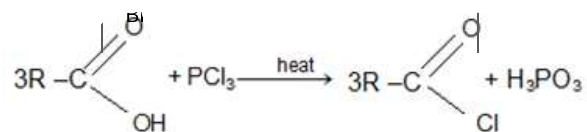


## Chemical Reactions of Carboxylic Acids

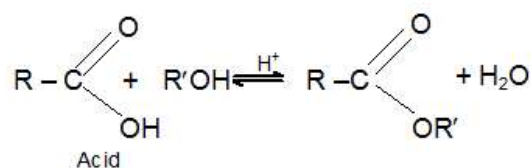
### a. Salt formation:



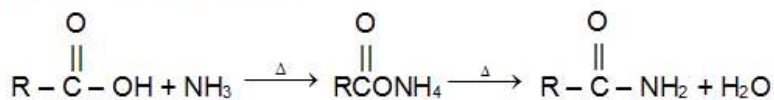
### b. Conversion into Acid Chlorides:



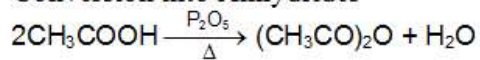
c. Conversion into Esters (Esterification)



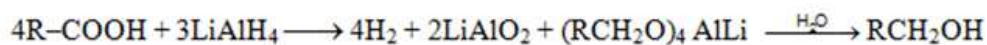
d. Conversion into Amides



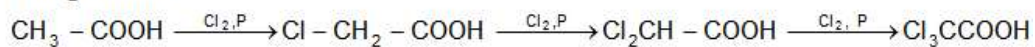
e. Conversion into Anhydrides



f. Reduction:

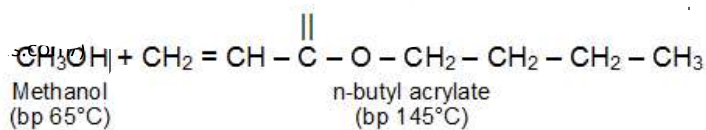


g. Halogenation:

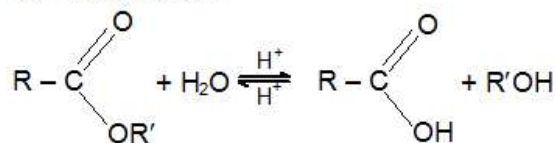


Esters

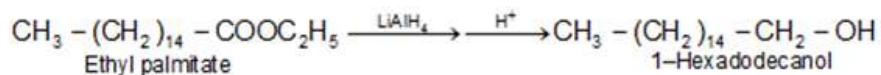
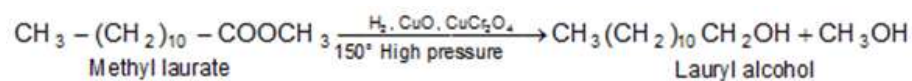
a) Transesterification :



**b) Hydrolysis:**

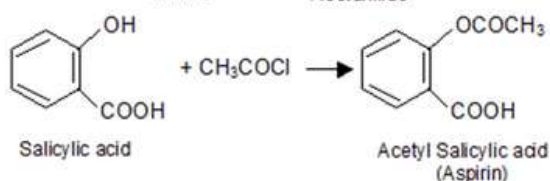
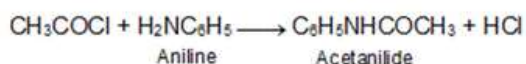
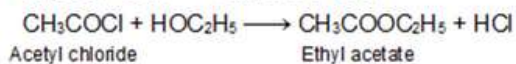


**c) Reduction:**

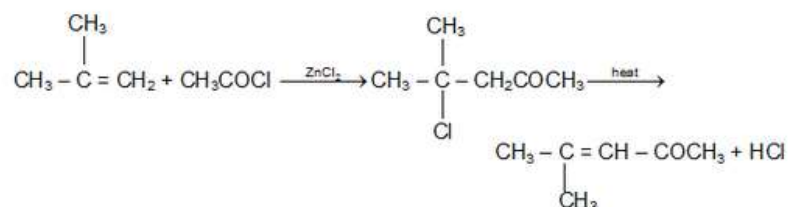


**Acid Chlorides:**

**a) Acetylation**

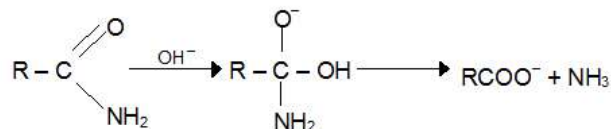
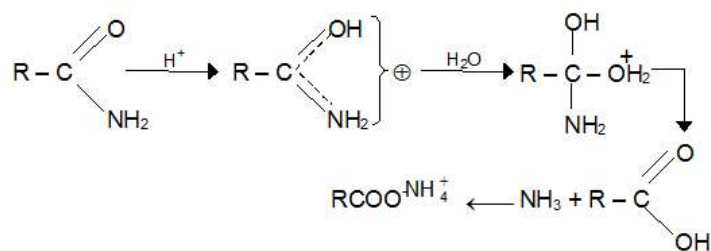


**b) Reaction with Olefins:**

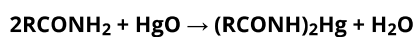


## Amides

### a. Hydrolysis:

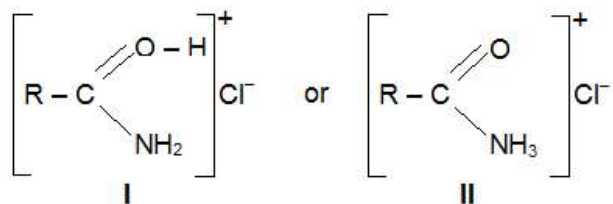


### b. Acidic Character of Amides:

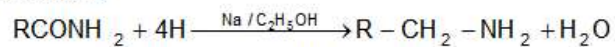


### c. Basic Character of Amides:

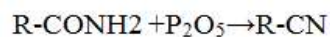
Amides are very feebly basic and form unstable salts with strong inorganic acids. e.g.  $\text{RCONH}_2\text{HCl}$ . The structure of these salts may be I or II



### d. Reduction:



### e. Reaction with Phosphorus Pentaoxide:



### Reaction with Nitrous Acid:

