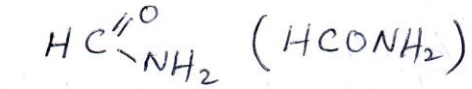
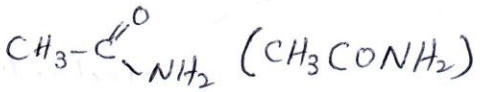
Amides (A2)

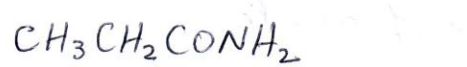
- derived from carboxylic acids.
- carboxylic acid contains the $-C(=O)-OH$ group, amides contain the $-C(=O)-NH_2$ group.
- some simple amides:



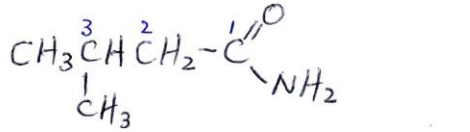
methanamide



ethanamide

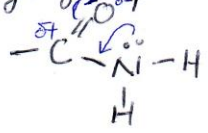


propanamide



3-methylbutanamide

- the name is derived from the acid by replacing the "oic acid" ending by "amide".
- amides have high boiling points because they can form hydrogen bonds. The hydrogen atoms in the $-NH_2$ group are sufficiently positive to form a hydrogen bond with a lone pair on the oxygen atom of another molecule
- amides are soluble in water because they have the ability to form hydrogen bond with water molecules.
- Solution of amides are neutral. This is because the presence of carbonyl group which withdraws electrons from N.



Formation of Amides

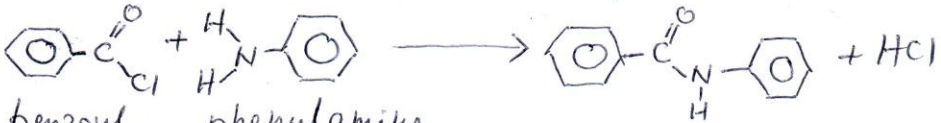
- reaction between an acyl chloride and NH_3 or amine.

eg.s

ethanoyl chloride — ethanamide + HCl

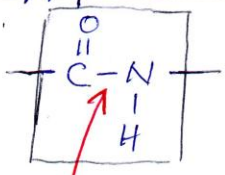
ethanoyl chloride + ethylamine → N-ethylethanamide + HCl

ethanoyl chloride + phenylamine → N-phenylethanamide + HCl



benzoyl chloride + phenylamine → N-phenylbenzamide + HCl

Amide/peptide linkage



covalent bond

Reactions of amides

1. Hydrolysis of amides
   - a) Acid hydrolysis
   - b) Alkaline hydrolysis
2. Reduction of amides.

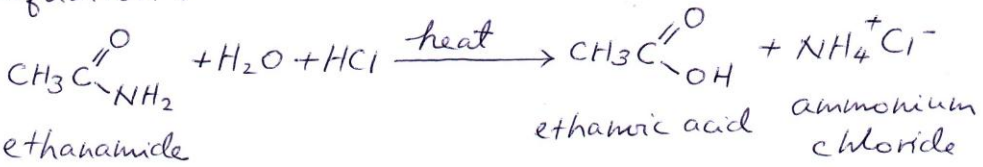
Acid hydrolysis of amides

reagent : dilute HCl

condition : heat

product : carboxylic acid and ammonium salt.

equation :



ethanamide — ethanoic acid — ammonium chloride

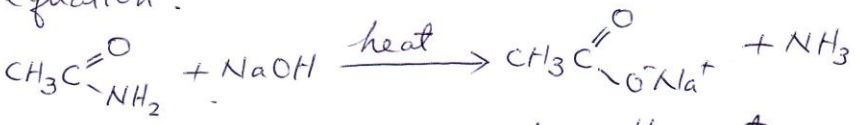
Alkaline hydrolysis of amides

reagent : NaOH(aq)

condition : heat

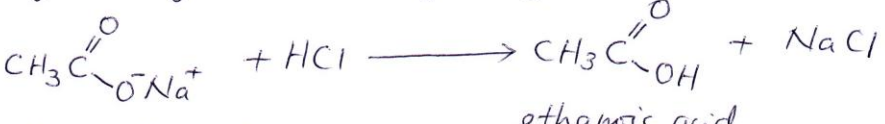
product : sodium salt of carboxylic acid and NH_3

equation :



ethanamide — sodium ethanoate

carboxylic acid can be released from its salt by adding acid subsequently.



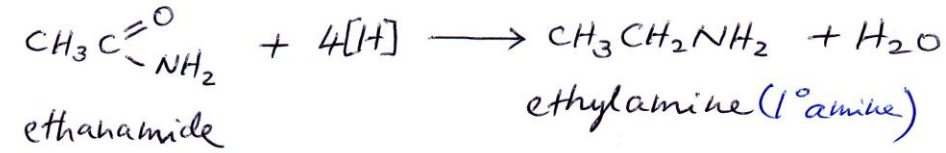
Sodium ethanoate — ethanoic acid.

Reduction of amides

reagent : $LiAlH_4$ (Lithium tetrahydridoaluminate(III)) in ether.

product : amines.

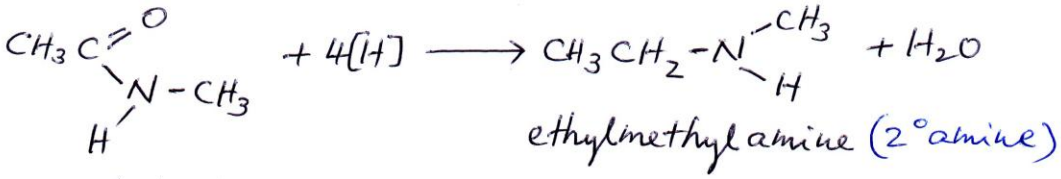
equation 1 :



$CH_3C(=O)NH_2 + 4[H] \longrightarrow CH_3CH_2NH_2 + H_2O$

ethanamide — ethylamine (1° amine)

equation 2 :



$CH_3C(=O)N(H)CH_3 + 4[H] \longrightarrow CH_3CH_2N(H)CH_3 + H_2O$

N-methyl ethanamide (N-substituted amide) — ethylmethylamine (2° amine)