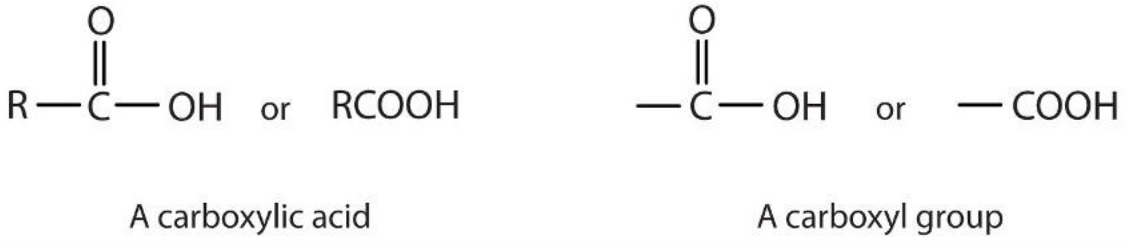
HW 20

Carboxylic acids – organic compounds containing carboxyl group COOH, note that the central carbon of the functional group is doubly bonded to the oxygen atom and singly bonded to hydroxyl group.




Remember that **Acids** can provide $H^+$ (proton) for reactions with other compounds.

$H2SO4 + Zn \rightarrow H2 + ZnSO4$

$HCl + Ag\ NO3 \rightarrow AgCl + HNO3$

In water solution acids dissociate:

$HCl + H2O = Cl^- + H^+$ proton usually is written in as $H_3O^+$ instead of $H^+$

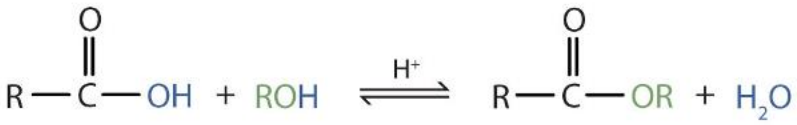
Acids undergo neutralization reaction with bases, the products of this reaction water and corresponding salt.

Carboxylic acids as well as inorganic acids provide proton for chemical reactions. In the solution carboxylic acids will undergo ionization with the formation of proton and negatively charged ion. This proton comes from OH group, and carboxylic acid will participate in all reactions typical for acids. For example, neutralization reaction will look like this:

$HCOOH + NaOH \rightarrow HCOONa + H_2O$

The product of the reaction is corresponding salt, it is ionic compound, generally charges are indicated $HCOO^-Na^+$

One of the specific reactions for carboxylic compounds – esterification reaction




R in organic chemistry represent “the rest of the molecule, part of the molecule that is outside of the functional group (it can be any alkyl group, benzene ring etc.)

Esterification reaction – reaction between carboxylic acid and alcohol, the product is ester, the products have very distinct smell, it can smell like different fruits.

The names and chemical formulas for carboxylic acids you can see in the following table:

| Formula | Common Name | Source | IUPAC Name | Melting Point | Boiling Point |
|---|---|---|---|---|---|
| $HCO_2H$ | formic acid | ants (L. formica) | methanoic acid | 8.4 ºC | 101 ºC |
| $CH_3CO_2H$ | acetic acid | vinegar (L. acetum) | ethanoic acid | 16.6 ºC | 118 ºC |
| $CH_3CH_2CO_2H$ | propionic acid | milk (Gk. protus prion) | propanoic acid | -20.8 ºC | 141 ºC |
| $CH_3(CH_2)_2CO_2H$ | butyric acid | butter (L. butyrum) | butanoic acid | -5.5 ºC | 164 ºC |
| $CH_3(CH_2)_3CO_2H$ | valeric acid | valerian root | pentanoic acid | -34.5 ºC | 186 ºC |
| $CH_3(CH_2)_4CO_2H$ | caproic acid | goats (L. caper) | hexanoic acid | -4.0 ºC | 205 ºC |
| $CH_3(CH_2)_5CO_2H$ | enanthic acid | vines (Gk. oenanthe) | heptanoic acid | -7.5 ºC | 223 ºC |
| $CH_3(CH_2)_6CO_2H$ | caprylic acid | goats (L. caper) | octanoic acid | 16.3 ºC | 239 ºC |
| $CH_3(CH_2)_7CO_2H$ | pelargonic acid | pelargonium (an herb) | nonanoic acid | 12.0 ºC | 253 ºC |
| $CH_3(CH_2)_8CO_2H$ | capric acid | goats (L. caper) | decanoic acid | 31.0 ºC | 219 ºC |

Remember that typical writing for carboxylic acids goes like this RCOOH, formic acid HCOOH, acetic acid CH3COOH, C2H5COOH propanoic acid etc.

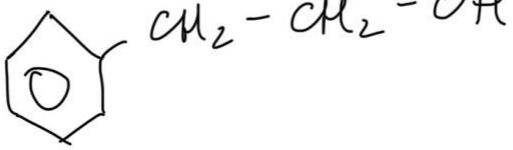
**Questions:**

I. Draw the condensed structural formula of the carboxylic acid formed by the oxidation of the following substances

1. $CH_3-CH_2-CH_2-CH_2-CH_2-OH$

2. $CH_3-CH_2-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-H$

3.



II. Write ionization equation for the following carboxylic acids in water

$H-\overset{\overset{O}{\|}}{C}-OH$ $\quad$ $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-OH$

III. Write neutralization reaction for the same acids. (see II)