

## ALKYL HALIDES

Alkyl halides are also known as haloalkanes. Alkyl halides are compounds in which one or more hydrogen atoms in an alkane have been replaced by halogen atoms (fluorine, chlorine, bromine or iodine). Some examples of Alkyl halide include:

### Classification Of Alkyl Halide

#### A. Number of Halogen Atoms

##### 1. Mono Haloalkane

Example:  $\text{CH}_3\text{-CH}_2\text{-X}$  [Where X can be Cl, F, Br or I]

##### 2. Dihaloalkane

Example:  $\text{X-CH}_2\text{-CH}_2\text{-X}$  [Where X can be Cl, F, Br or I]

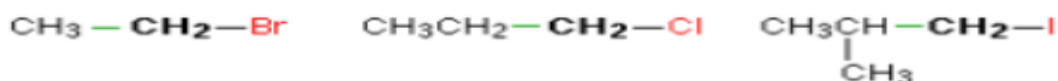
##### 3. Trihaloalkane

Example:  $\text{X-CH}_2\text{-CHX-CH}_2\text{-X}$  [Where X can be Cl, F, Br or I]

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#### B. The Position of Halogen atom Along the Chain of Carbon Atom

##### 1. Primary alkyl halide



##### 2. Secondary alkyl halide



##### 3. Tertiary alkyl halide



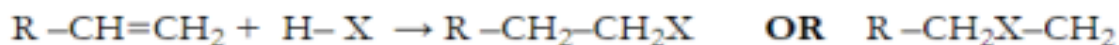
## Preparation Alkyl Halides

### 1. Preparing Alkyl Halides from Alkanes: Radical Halogenation

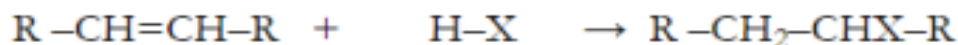


### 2. Preparing Alkyl Halides from alkenes

#### General Reaction



Alkene      Hydrogen halide      Alkyl halide



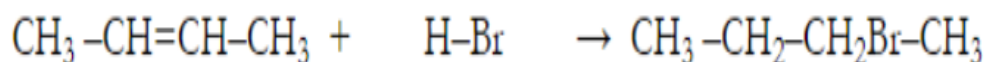
Symmetric alkene      Hydrogen halide      alkyl halide

#### Example – 1: Preparation of ethyl chloride (Chloroethane) from Ethylene (Ethene):



Ethylene      hydrogen chloride      Ethyl chloride

## Example 2/



butylene                  Hydrogen bromide          sec-butyl bromide

### 3. Preparing Alkyl Halides from alcohols

#### General Reaction:

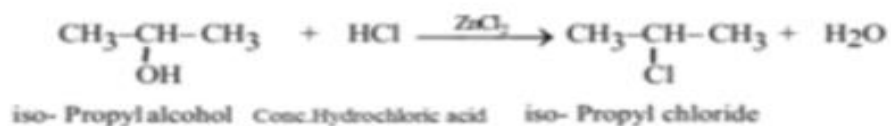


Alcohol          Halogen acid          alkyl halide

#### Example 1:-

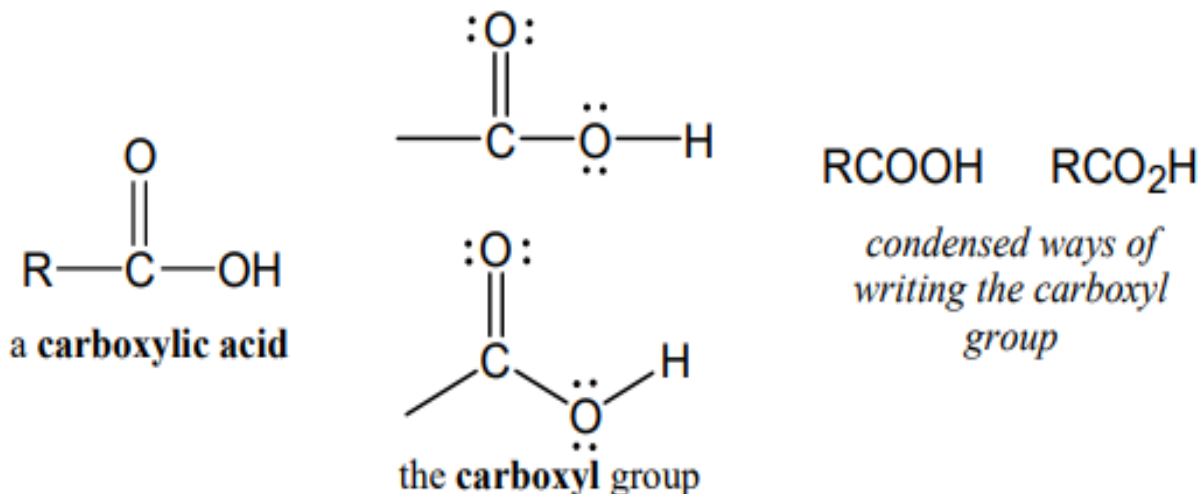


#### Example – 2: (Preparation of isopropyl chloride (2-Chloropropane) from isopropyl alcohol (Propan-2-ol):



## Carboxylic acids

- **Carboxylic acids** are weak organic acids which contain the **carboxyl group** ( $\text{RCO}_2\text{H}$ ):



- The tart flavor of sour-tasting foods is often caused by the presence of carboxylic acids.

## Nomenclature

### IUPAC formulation

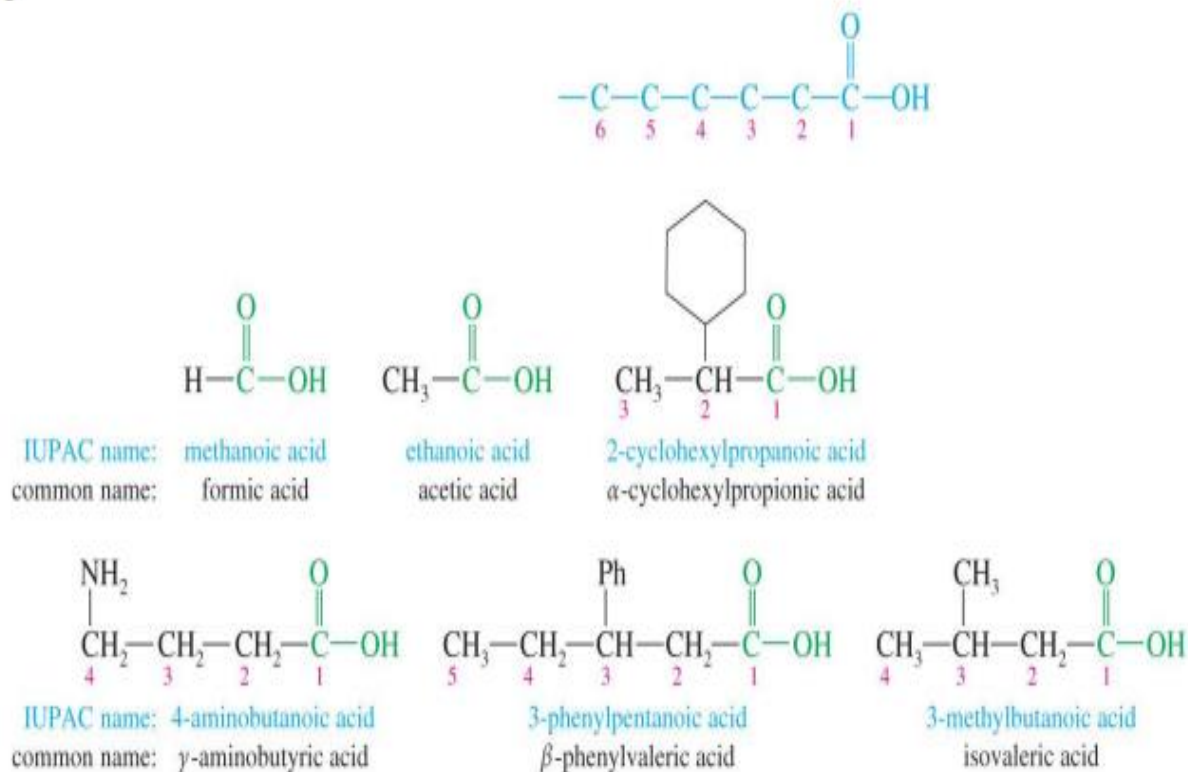
The root name is based on the longest continuous chain of carbon atoms bearing the carboxyl group.

The *-e* is replaced by *-oic acid*.

The chain is numbered **starting with the carboxyl carbon atom**.

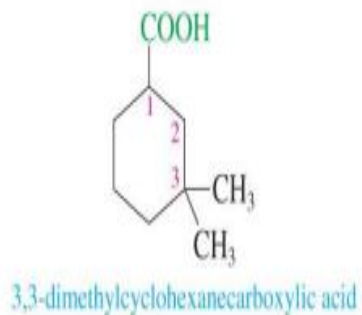
The carboxyl group takes priority over any other functional groups previously discussed.

E.g.

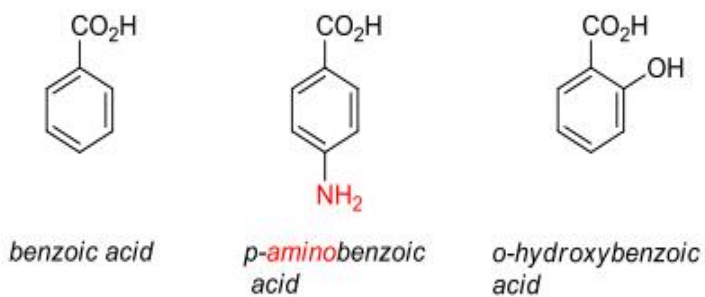


Cycloalkanes with carboxyl substituents are named as *cycloalkanecarboxylic acids*.

E.g.



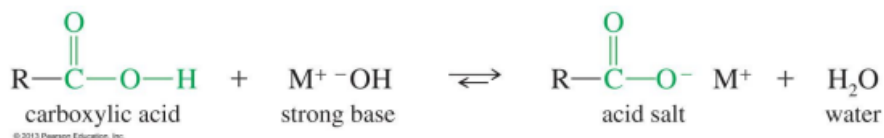
Typically *aromatic acids* of the form **Ar-CO<sub>2</sub>H** are named as derivatives of benzoic acids, with *ortho*, *meta* and *para* indicating the location relative to the carboxyl group. (Recall that this is **non-IUPAC**).



### Salts of carboxylic Acids

Strong bases can *completely* deprotonate carboxylic acids, thus *salts* of carboxylic acids are formed.

E.g.

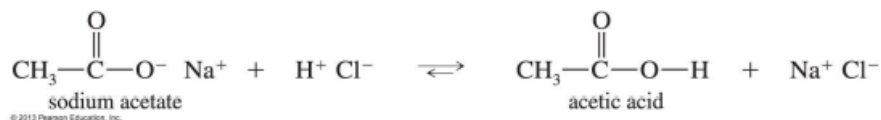


The acid can be *regenerated* by protonation (acidification) of the salt.

E.g.



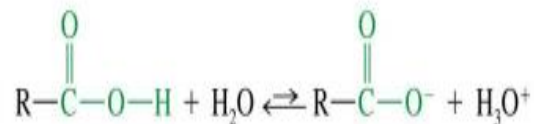
### *Example*



### Acidity

Carboxylic acids can dissociate in aqueous solution into *carboxylate* ions and protons.

The equilibrium constant for this process is  $K_a$ , and more frequently we talk in terms of  $pK_a$ .

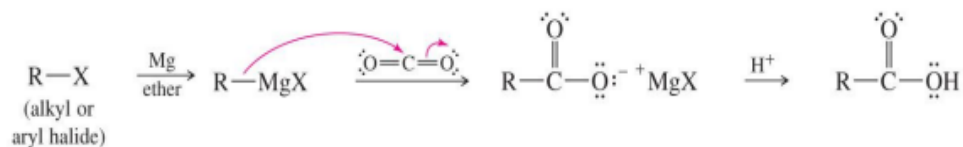


$$K_a = \frac{[\text{R}-\text{CO}_2^-][\text{H}_3\text{O}^+]}{[\text{R}-\text{CO}_2\text{H}]}$$

$$pK_a = -\log_{10} K_a$$

### Carboxylation of Grignard Reagents

Grignard reagents can react as *nucleophiles* and attack carbon dioxide.



This results in magnesium salts of carboxylic acids, and treatment with dilute acid produces a carboxylic acid.

The overall transformation is from alkyl halide to a carboxylic acid with an *extra* carbon atom.

E.g.

