Organic Chemistry
Ch(8) : Functional groups

I-organic compounds and families

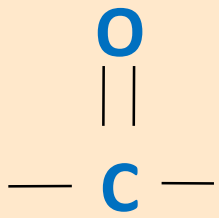
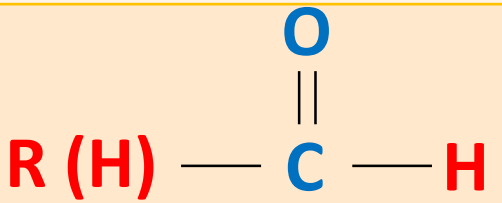
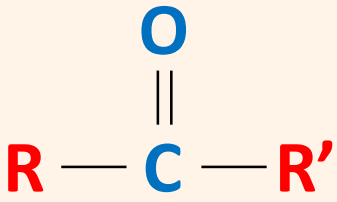
Organic compounds are compounds that consist of carbon and hydrogen with combination with other elements such as oxygen, nitrogen, chlorine, sulfur and others.

Organic compounds are classified into families.

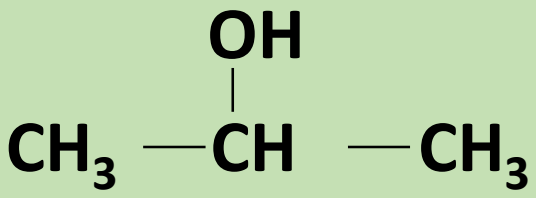
Each family is characterized by its general molecular formula and its functional group.

Each functional group has a specific characteristics and it determines the chemical reactivity of each family.

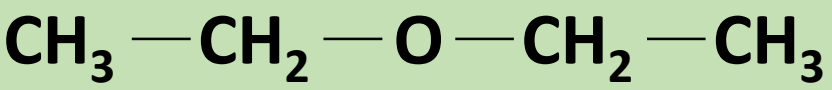
Family name	General molecular formula	Functional group	General condensed formula
Alcohols	$C_nH_{2n+2}O$	-OH Hydroxyl group	R-O-H
Ethers		- O – Ether oxide group	R-O-R’

Family name	General molecular formula	Functional group	General condensed formula
Aldehydes	$C_nH_{2n}O$	 Carbonyl group	
Ketones			

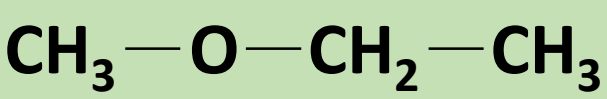
Application 1: Deduce the general formula and the family of each of the following :



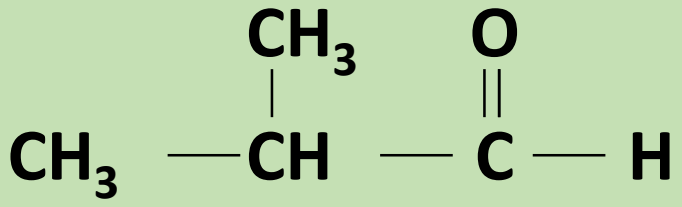
$C_3H_8O = C_nH_{2n+2}O$
Alcohol



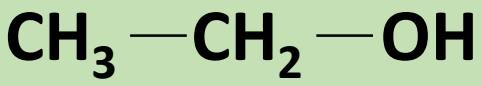
$C_4H_{10}O = C_nH_{2n+2}O$
Ether



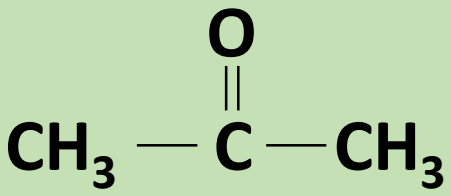
$C_3H_8O = C_nH_{2n+2}O$
Ether



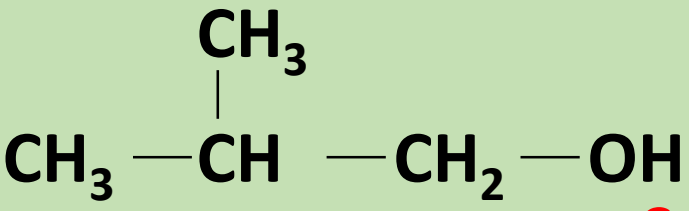
$C_4H_8O = C_nH_{2n}O$
Aldehyde



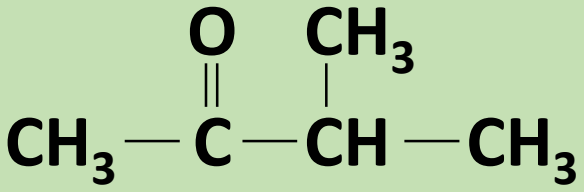
$C_2H_6O = C_nH_{2n+2}O$
Alcohol



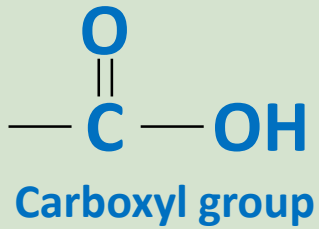
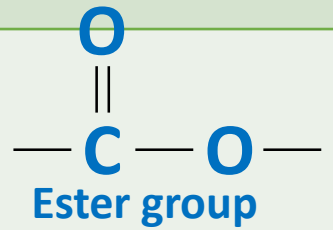
$C_3H_6O = C_nH_{2n}O$
Ketone



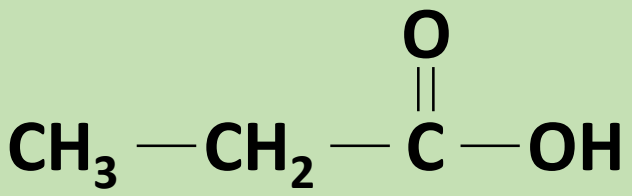
$C_4H_{10}O = C_nH_{2n+2}O$
Alcohol



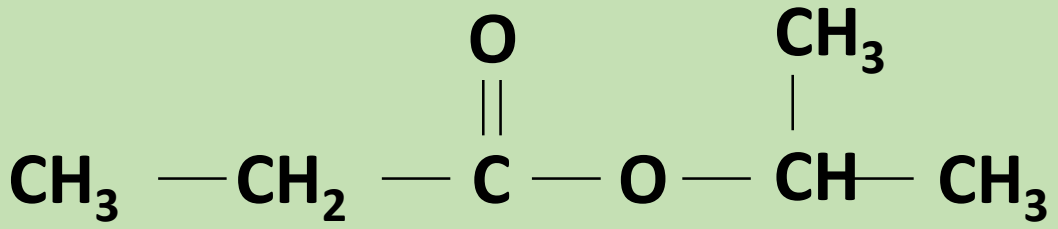
$C_5H_{10}O = C_nH_{2n}O$
Ketone

Family name	General molecular formula	Functional group	General condensed formula
Carboxylic acids	$C_nH_{2n}O_2$	 Carboxyl group	
Esters		 Ester group	

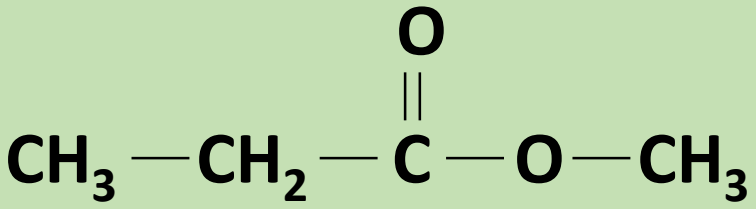
Application 2 : Deduce the general formula and the family of each of the following :



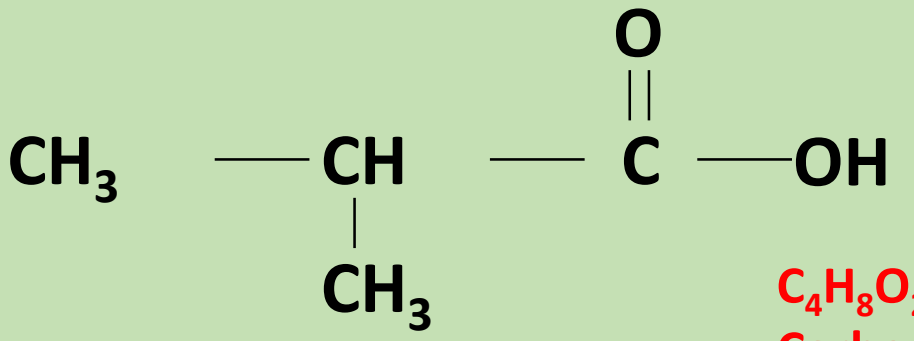
$C_3H_6O_2 = C_nH_{2n}O_2$
Carboxylic acid



$C_6H_{12}O_2 = C_nH_{2n}O_2$
Ester



$C_4H_8O_2 = C_nH_{2n}O_2$
Ester



$C_4H_8O_2 = C_nH_{2n}O_2$
Carboxylic acid

Application 3

Write the possible condensed structural formulas of the possible isomers of $C_4H_{10}O$.

$C_4H_{10}O$ belongs to $C_nH_{2n+2}O$, it may be alcohol or ether

The possible alcohol isomers are:

(A) $CH_2(OH)-CH_2-CH_2-CH_3$ (B) $CH_3-CH_2-CH(OH)-CH_3$ (C) $CH_2(OH)-CH(CH_3)-CH_3$ (D) $CH_3-C(CH_3)(OH)-CH_3$

The possible ether isomers are :

(E) $CH_3-CH_2-O-CH_2-CH_3$ (F) $CH_3-CH_2-CH_2-O-CH_3$ (G) $CH_3-CH(CH_3)-O-CH_3$

Positional isomers

(A) and (B)
(E) and (F)
(C) and (D)

Skeletal isomers

(A) and (C)
(A) and (D)
(B) and (C)
(E) and (G) …

Functional isomers

(A) and (E)
(A) and (F) …
(B) and (E) …
(C) and (E) …

II-Isomers in organic chemistry

There are three types of isomers in organic chemistry :

1. **Skeletal isomers: are compounds that have the same molecular formula but they differ in the main chains.**

2. Positional isomers: are compounds that have the same molecular formula, same main chain and same functional groups but in different positions.

3. Functional isomers: are compounds that have the same molecular formula but different functional groups.