Worksheet: Naming Carboxylic Acids and Alcohols (IUPAC) for Year 11

1. Functional Group Priority Order

The functional group with the **highest priority** gives the molecule its ending (suffix).

Order of priority	**Functional Group**	**Formula**	**Suffix when priority**	**Prefix when NOT priority**
1	Carboxyl	–COOH	**-oic acid**	Highest priority functional group studied in this course
2	Hydroxyl	–OH	**-ol**	hydroxy-
3	Amine	$-NH_2$	**amine**	amino

Side branch	Name
Cl-	chloro
Br-	bromo
F-	fluoro
I-	iodo
CH_3-	methyl
CH_3CH_2-	ethyl
-OH	hydroxy
$-NH_2$	amino

Table 1- name of side branches when naming carboxylic acids

2. Steps for Naming Carboxylic Acids

1. Find the **longest carbon chain** containing the –COOH group.
2. Count the carbon in the –COOH group as carbon 1. This should be at the end of the chain and as such that is why the carboxyl group has carbon number 1
3. Name the parent chain:
    - 1 carbon = meth-
    - 2 carbons = eth-
    - 3 carbons = prop-
    - 4 carbons = but-
    - 5 carbons = pent-
4. Replace the "-e" of the alkane with **"-oic acid."**
5. Name any side branches and number the carbon atoms so that these side branches attach to the lowest possible numbered carbons.
6. Put branches in alphabetical order.
7. Write the full name.
    i. A "," is placed between numbers a "-" is placed between a number and a letter.
    ii. Prefix of di, tri or tetra is used for multiple identical side branches.

Examples of Carboxylic Acids

Structure	**Name**
HCOOH	methanoic acid
CH_3COOH	ethanoic acid
CH_3CH_2COOH	propanoic acid
$CH_3CH_2CH_2COOH$	butanoic acid
$CH_3CH(CH_3)COOH$	2-methylpropanoic acid
$HOOCCH_2CH_2CH_3$	butanoic acid
$CH_3CH_2CH(CH_3)COOH$	2-methylbutanoic acid
$HOOCCH_2CH_2CH_2CH_3$	pentanoic acid

3. Steps for Naming Alcohols

1. Find the **longest carbon chain** containing the –OH group.
2. Number the chain so the –OH gets the **lowest possible carbon number**.
3. Name the parent molecule.

   -Remove the "-e" from the alkane name and add **"-ol."**
4. Write the position number of the –OH group.
5. Name and number any branches.
6. Put branches in alphabetical order.
7. Write the complete name (no space)

   i. A "," is placed between numbers a "-" is placed between a number and a letter.
   ii. Prefix of di, tri or tetra is used for multiple identical side branches.

Example

i. 2,3-dichloropropanoic acid

The name should allow someone to accurately draw the compound. Here, we know that on propanoic acid we have two chlorines on carbon 2 and 3.

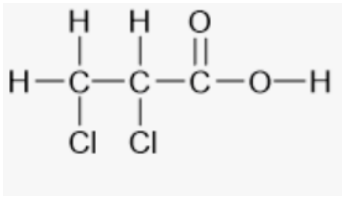


Figure 1 - structural formula of 2,3-dichloropropanoic acid

ii. 3-methylbutanoic acid

Here, we know that on butanoic acid we have a methyl group on carbon 3.

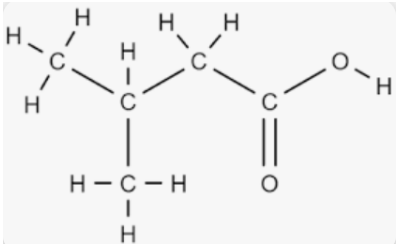


Figure 2 – structural formula of 3-methylbutanoic acid

3. Steps for Naming Alkenes

1. Find the **longest carbon chain** containing the C=C double bond.
2. Number the chain so the C=C gets the **lowest possible carbon number**.
3. Name the parent alkene.

   Remove the "-ane" from the alkane name and add **"-ene."**
4. Write the position number of the C=C group.
5. Name and number any branches.
6. Put branches in alphabetical order.
7. Write the complete name (no space)

   i. A "," is placed between numbers a "-" is placed between a number and a letter.
   ii. Prefix of di, tri or tetra is used for multiple identical side branches.

Example

j. But-2-ene

The name should allow someone to accurately draw the compound. Here, we know that the double bond in butene comes off the second carbon.

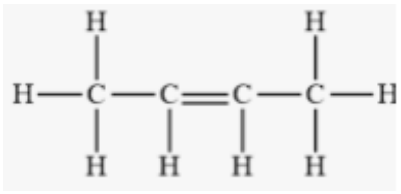


Figure 1 - structural formula of but-2-ene

ii. 3-methylbutanoic acid

Here, we know that on but-2-ene we have a methyl group on carbon 2.

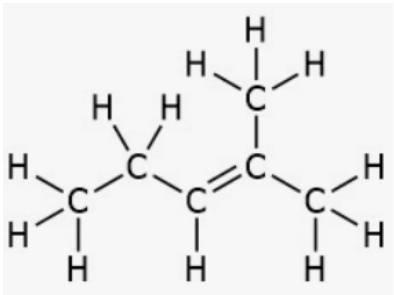
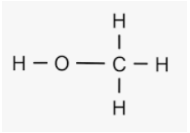
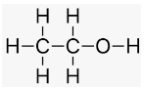
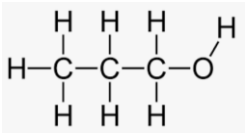
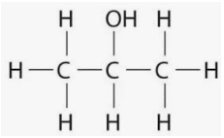
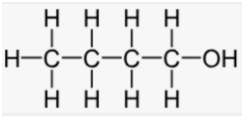
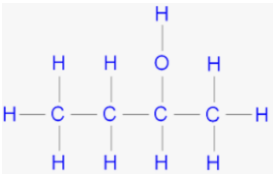
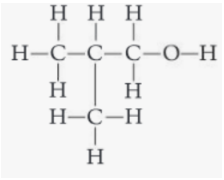


Figure 2 – structural formula of 3-methylbut-2-ene

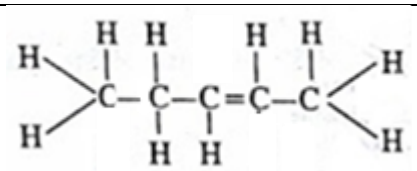
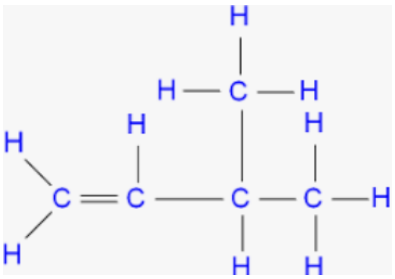
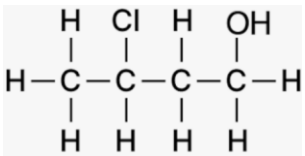
Examples of Alcohols

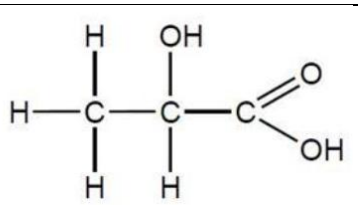
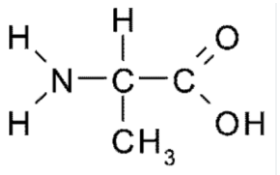
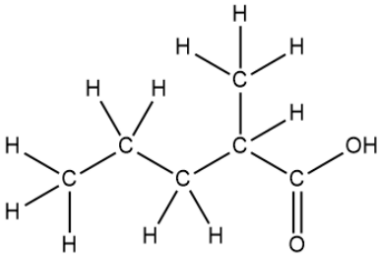
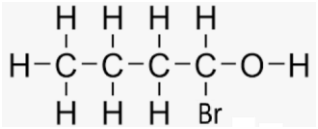
Semi Structural formula	Name	Structural formula
CH_3OH	methanol	
CH_3CH_2OH	ethanol	
$CH_3CH_2CH_2OH$	propan-1-ol	
$CH_3CHOHCH_3$	propan-2-ol	
$CH_3CH_2CH_2CH_2OH$	butan-1-ol	
$CH_3CH(OH)CH_2CH_3$	butan-2-ol	
$CH_3CH(CH_3)CH_2OH$	2-methylpropan-1-ol	

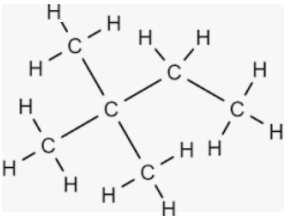
4. Functional Groups as Prefixes (NOT Priority)

Functional Group	When Highest Priority	When Lower Priority
–OH	ol (alcohol)	hydroxy
-NH_2	amine	amino

1. Try these. Complete the table below.

Name	Molecular formula	Structure
3-chloro-2-methylbutanoic acid		
	C_5H_{10}	
Pent-1-ene	C_5H_{10}	
	C_5H_{10}	
2-aminopropanoic acid		
		

		
2,3-dichloropent-2-ene		
4-aminobutanoic acid		
		
3-bromo-4-hydroxybutanoic acid		
		
		
2-methylbutane		

2,2-dimethylpropane		
Pentane	C_5H_{12}	
Hexane	C_6H_{14}	
		

2. Isomers are molecules that have the exact same molecular formula (same number and type of atoms) but different arrangements of those atoms in space. Because of these different structures, isomers often have entirely distinct chemical and physical properties.

    a. Using the completed table in question 1 above answer the following questions.

    i. Name all the isomers of pentane present in the table

    ii. Name the isomers of pentene present in the table

    iii. Name the isomers of hexane present in the table

b. In the space below, draw and name three of the four different isomers with the formula C_4H_9Cl.