Demonstrate understanding of the properties of organic compounds

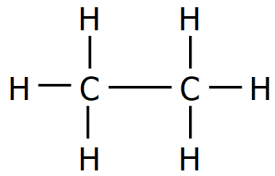
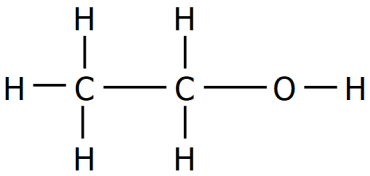
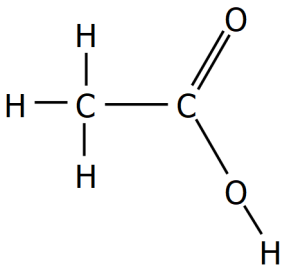
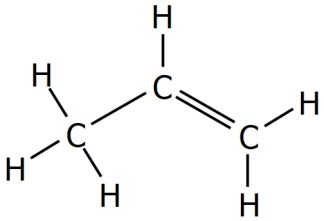
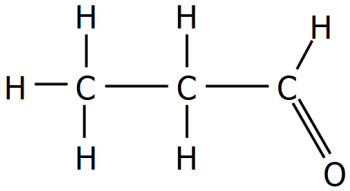
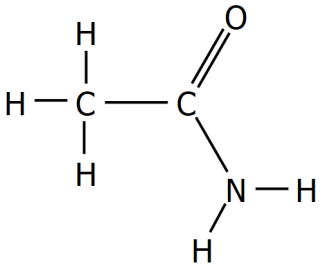
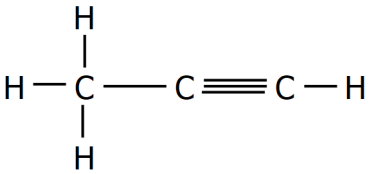
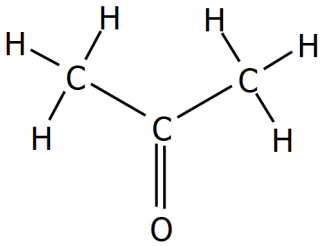
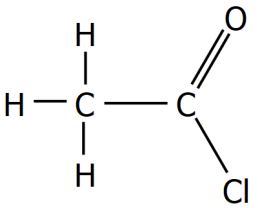
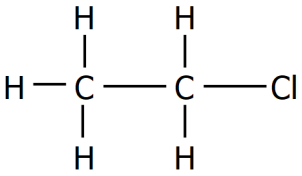
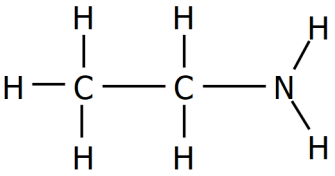
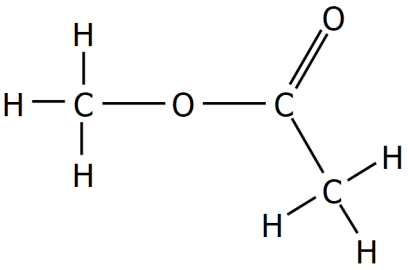
Naming Organic Molecules

Step 1 – Be able to count to eight! The base part of the name reflects the number of carbons in what you will assign to the parent chain.

meth, eth, prop, but, pent, hex, hept, oct

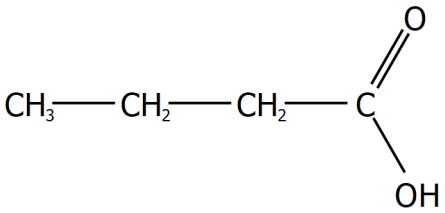
The names of the substituents formed by the removal of one hydrogen from the end of the chain is obtained by changing the suffix -ane to -yl. E.g. CH_3- is methyl, C_2H_5- is ethyl, etc.

Step 2 - Know your functional groups!

Alkane 	Alcohol 	Carboxylic acid 
Alkene 	Aldehyde 	Amide 
Alkyne 	Ketone 	Acyl / acid chloride 
Haloalkane 	Amine 	Ester 

This is NOT an exhaustive list of rules but a guide for L3 NCEA.

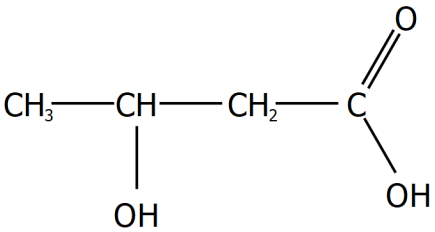
Identify the principle functional group in the structure. If there is only ONE functional group then this is the principle functional group e.g. $CH_3CH_2CH_2COOH$ will have the suffix -oic acid as the carboxylic acid is the principle functional group.



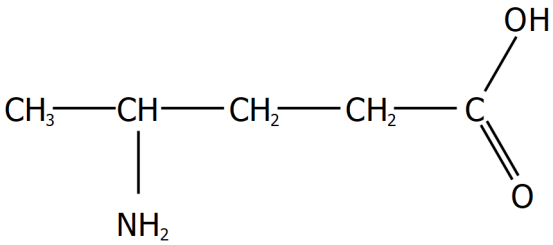
In cases where compounds have more than one functional group, then the principle functional group is decided by a priority order.

carboxylic acids > acid derivatives* > aldehydes > ketones > alcohols > amines

*esters, acyl/acid chlorides and amides



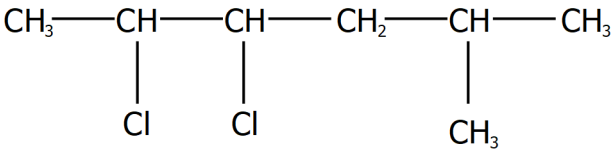
3-hydroxybutanoic acid



4-aminopentanoic acid

as the carboxylic acid functional group takes priority

Fluoro-, chloro-, bromo-, iodo- and alkyl groups have "no priority". Their numbering is governed by the lowest sum rule.

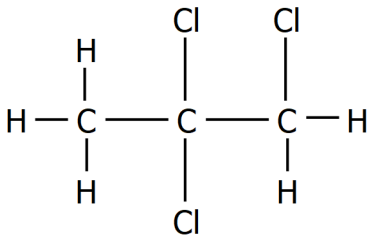


2,3-dichloro-4-methylhexane and NOT 4,5-dichloro-2-methylhexane

(as 2+3+4 = 9 whereas 2+4+5 = 11)

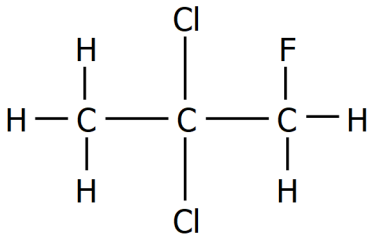
Rules

1. Identify the longest carbon chain. This chain is called the parent chain.
2. Identify all of the substituents (groups attached to the parent chain).
3. Number the carbons of the parent chain from the end that gives the substituents the lowest numbers. (If the first substituents from either end have the same number, then number so that the second substituent has the smaller number, etc.)
4. If the same substituent occurs more than once, the location of each point on which the substituent occurs is given. In addition, the number of times the substituent group occurs is indicated by a prefix (di, tri, tetra, etc.).



1,2,2-trichloropropane

5. If there are two or more different substituents they are listed in alphabetical order using the base name (ignore the prefixes di, tri etc).

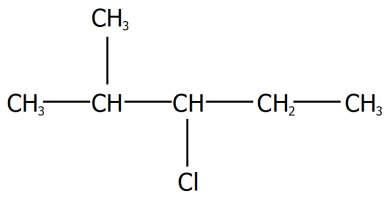


2,2-dichloro-1-fluoropropane

In summary, the name of the compound is written out with the substituents in alphabetical order followed by the base name (derived from the number of carbons in the parent chain). Commas are used between numbers and dashes are used between letters and numbers. There are no spaces in the name.

Alkyl halide: F fluoro-, Cl chloro-, Br bromo-, I iodo-

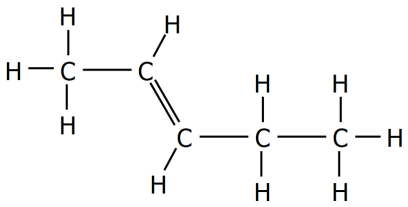
The halogen is treated as a substituent on an alkane chain. The halo- substituent is of equal rank with an alkyl substituent in the numbering of the parent chain. The halogens are represented as follows: (c is alphabetically before m).



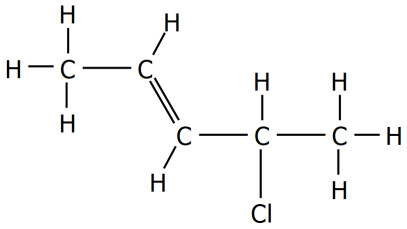
3-chloro-2-methylpentane and NOT 2-methyl-3-chloropentane

Alkenes and Alkynes - unsaturated hydrocarbons

Double bonds are indicated by replacing the -ane with -ene. Triple bonds are named using -yne. The position of the multiple bond within the parent chain is indicated by placing the number of the first carbon of the multiple bond directly the base name.



pent-2-ene



4-chloropent-2-ene

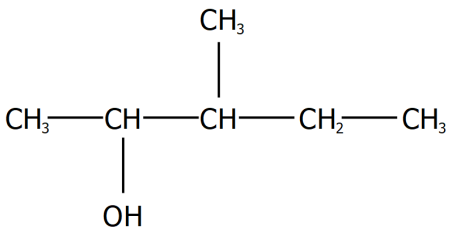
The parent chain is numbered so that multiple bonds have the lowest numbers; double and triple bonds have priority over alkyl and halo substituents.

Alcohols

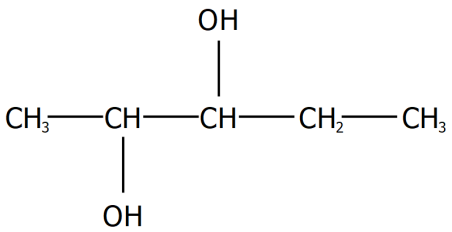
Alcohols are named by replacing the suffix -ane with -anol. The position of the hydroxyl group(s) on the parent chain is(are) indicated by placing the number(s) corresponding to the location(s) on the parent chain directly in front of the base name (same as alkenes).

The hydroxy OH group takes precedence over alkyl groups and halogen substituents, as well as double bonds, in the numbering of the parent chain.

If there is more than one hydroxy group (-OH), the suffix is expanded to include a prefix that indicates the number of hydroxy groups present (-anediol, -anetriol, etc.).



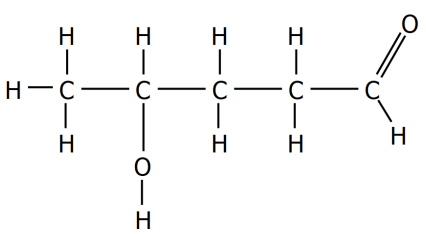
3-methylpentan-2-ol



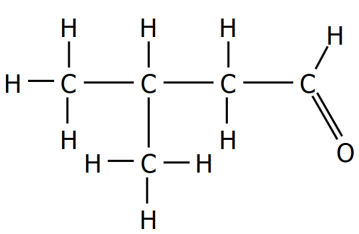
2,3-pentanediol / pentane-2,3-diol

Aldehydes

Aldehydes are named by replacing the -ane with -anal. It is not necessary to indicate the position of the -CHO group because this group will be at the end of the parent chain and its carbon is automatically C-1. The carbonyl group takes precedence over alkyl groups and halogen substituents, as well as double bonds, in the numbering of the parent chain.



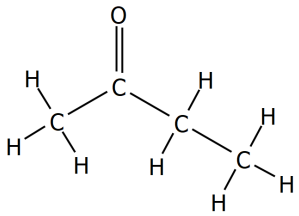
4-hydroxypentanal



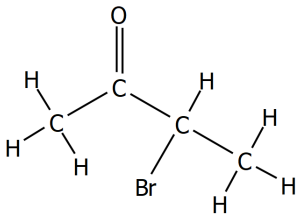
3-methybutanal

Ketones

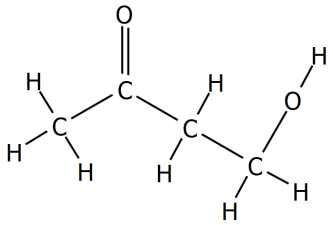
Ketones are named by replacing -ane with -anone. The position of the carbonyl group(s) on the parent chain is(are) indicated by placing the number(s) corresponding to the location(s) on the parent chain in the base name (same as alkenes). The carbonyl gets priority in the numbering of the parent chain and takes precedence over alkyl groups and halogen substituents in the numbering of the parent chain.



butan-2-one



3-bromobutan-2-one

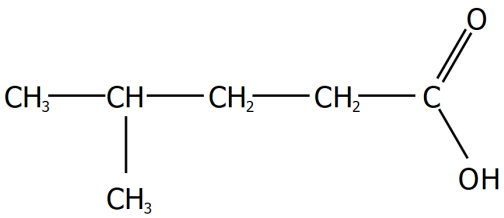


4-hydroxybutan-2-one

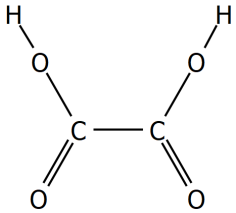
Carboxylic Acids

Carboxylic acids are named by counting the number of carbons in the longest continuous chain including the carboxyl group and by replacing the -ane of the corresponding alkane with -anoic acid. This group will be at the end of the parent chain and its carbon is automatically assigned as C-1 and so it is not necessary to indicate the position of the -COOH group.

If there are two -COOH groups, the suffix is expanded to indicate the number of -COOH groups present (anedioic acid). The carboxyl group takes precedence over alkyl groups and halogen substituents, as well as double bonds, in the numbering of the parent chain.



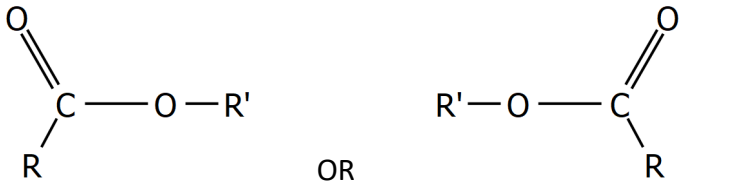
4-methylpentanoicacid



ethanedioic acid

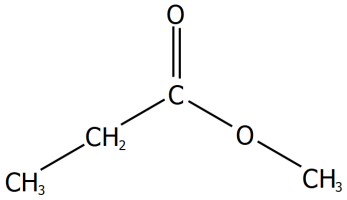
Esters

Esters are based on the name of the corresponding carboxylic acid. Remember esters look like this:

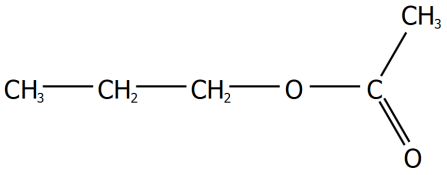


acyl group alkyl group OR alkyl group acyl group

The alkyl group is named like a substituent using the -yl ending. The acyl portion of the name (what is left over) is named by replacing the -ic acid suffix of the carboxylic acid with -ate.



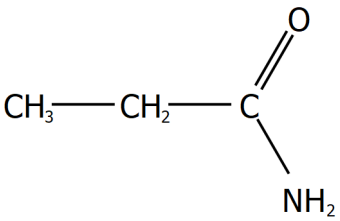
methyl propanoate



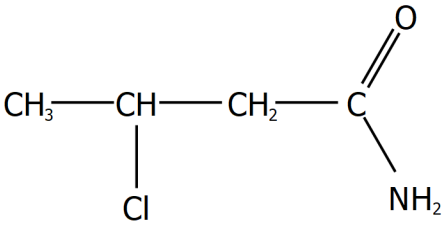
propyl ethanoate

Amides and Acid (Acyl) chlorides

According to the IUPAC rules, the -oic term in a carboxylic acid name is replaced by amide.



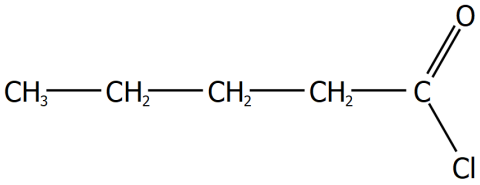
propanamide



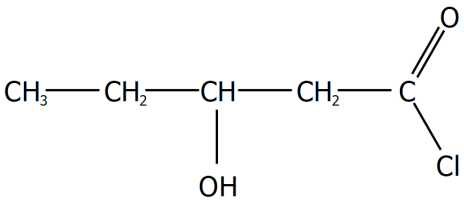
3-chlorobutanamide

If alkyl group is attached to the nitrogen atom then it is named as N-alkyl in front of the amide name, but at L3 you will only need to name primary amides.

Acid chlorides are named according to the same system as other organic compounds.



pentanoyl chloride

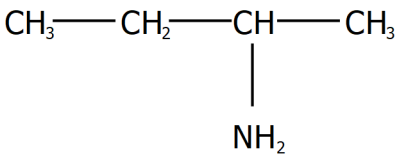


3-hydroxy pentanoyl chloride

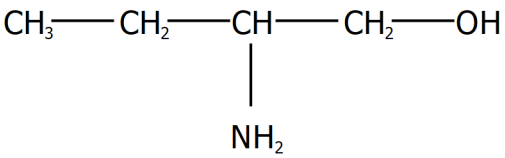
Amines

(At L3 you will only need to name primary amines. Primary amines have one alkyl group attached to the N.)

The root name is based on the longest chain with the -NH_2 attached. The chain is numbered so as to give the amine unit the lowest possible number.



butan-2-amine



2-aminobutan-1-ol

NCEA (certainly in recent years) also accepts 2-aminobutane as an alternative for butan-2-amine.