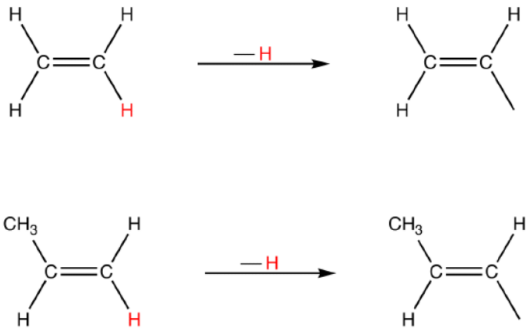
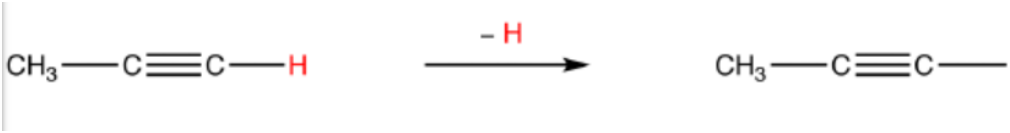
Identification of different classes:
alkanes, alkenes, alkynes, halogenoalkanes, alcohols, ethers, aldehydes, ketones, esters, carboxylic acids, amines, amides, nitriles and arenes.

Identification of typical functional groups in molecules
phenyl, hydroxyl, carbonyl, carboxyl, carboxamide, aldehyde, ester, ether, amine, nitrile, alkyl,alkenyl and alkynyl.

An alkenyl group is the fragment, containing an open point of attachment on a carbon atom, that would form if a hydrogen atom bonded to a doubly bonded carbon is removed from the molecule of an alkene.



An alkynyl group is the fragment, containing an open point of attachment on a carbon atom, that would form if a hydrogen atom bonded to a triply bonded carbon is removed from the molecule of an alkyne.



nomenclature

– non-cyclic alkanes and halogenoalkanes up to halohexanes.

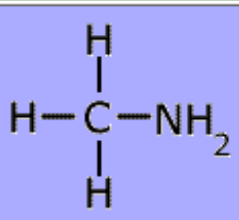
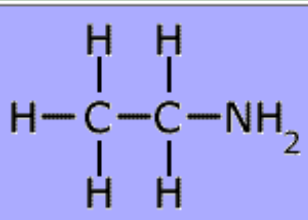
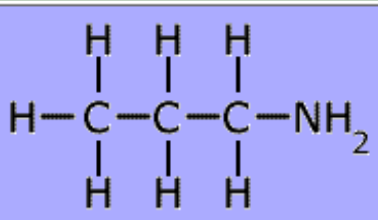
– alkenes up to hexene and alkynes up to hexyne.

– compounds up to six carbon atoms (in the basic chain for nomenclature purposes) containing only one of the classes of functional groups: alcohols, ethers, aldehydes, halogenoalkanes ketones, esters and carboxylic acids.

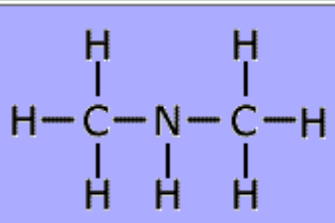
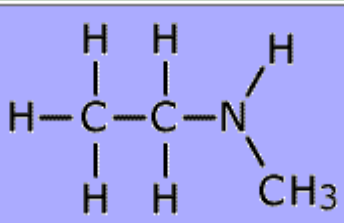
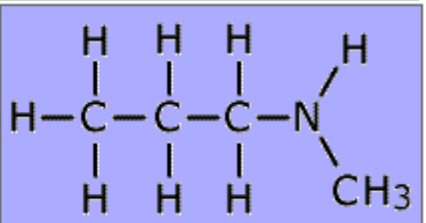
Amines contain nitrogen atoms attached to either alkyl groups or hydrogen and alkyl groups. It can be considered as an ammonia molecule in which one, or more, of the hydrogen atoms has been replaced by an alkyl group.

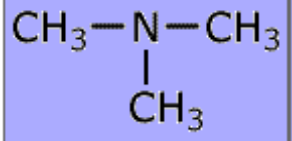
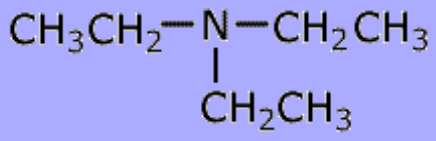
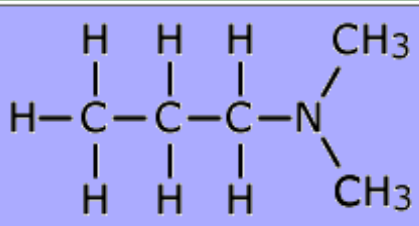
The basic structure of an amine is R-NH2 (where 'R' represents an alkyl chain). The alkyl group can occupy either one, two or three sites on the nitrogen giving rise to primary, secondary and tertiary amines.

The names of amines come from the longest alkyl chain name plus -amine as a suffix.

Structures and names of primary amines		
		
methylamine	ethylamine	propylamine

The prefix 'N'- to indicate that it is attached to the nitrogen. This is a common way to show where groups are located when heteroatoms are involved.

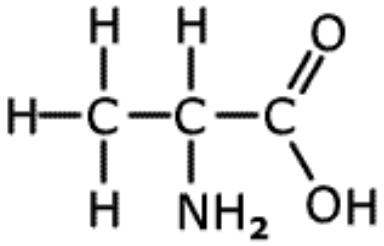
Structures and names of secondary amines		
		
dimethylamine	methylethylamine	N-methylpropylamine

Structures and names of tertiary amines		
		
trimethylamine	triethylamine	N,N-dimethylpropylamine

Amines are often found in molecules that also have carboxylic acid groups. Such molecules are called amino acids.

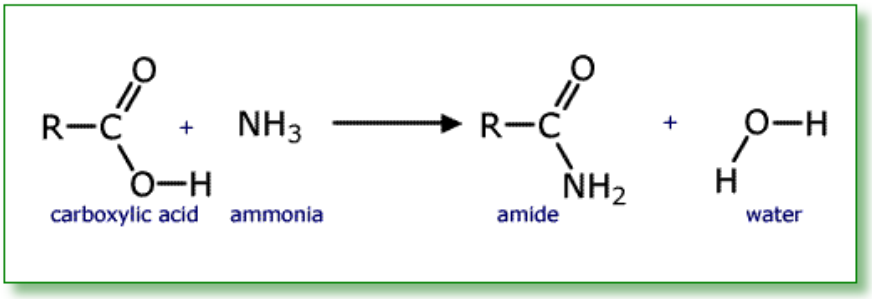
Some of the common amino acids have much more complicated structures, but they all contain at least one amine group and one acid group.

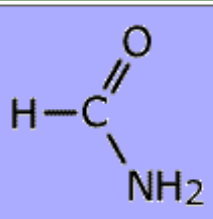
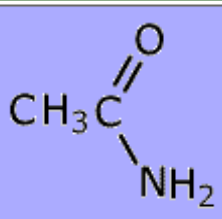
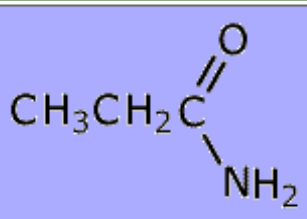
2-aminopropanoic acid



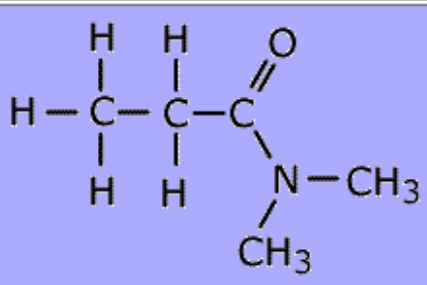
Amides are quite distinct from amines even though they do have an -NH_2 group. Amides are considered to be derivatives of carboxylic acids as they can be made from them by reaction with ammonia (or ammonium carbonate). They have a carbonyl group attached to the NH_2 group of atoms, a carboxamide group.

The synthesis of an amide from a carboxylic acid

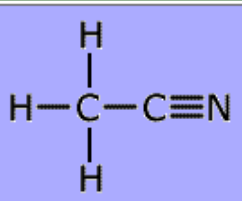
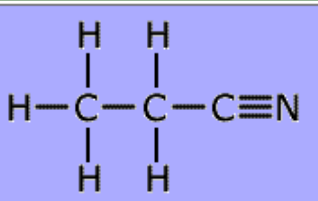
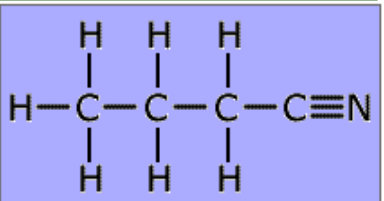


Structures and names of amides		
		
methanamide	ethanamide	propanamide

Once again, there may be alkyl groups attached to the nitrogen atom and in case of ambiguity they are prefixed by the letter 'N'.

An N,N disubstituted amide

N,N-dimethylpropanamide

Nitriles contain the -CN termination at the end of an alkyl chain, called a nitrile group. They are also considered to be derivatives of carboxylic acids and take their names from the acid name with the same number of carbon atoms including the carbon of the nitrile group. Hence, the name of the nitrile with four carbons is butanonitrile (the 'o' is usually included to make it easier to say)

Structures and names of nitriles		
		
ethanonitrile	propanonitrile	butanonitrile

A bridging oxygen atom is one that links together two parts of a molecule.

The two common homologous series that contain oxygen bridges are ethers and esters. Ethers have a simple oxygen bridge between two alkyl groups, -O-.

Ethers take their names from the longest alkyl chain attached to the oxygen, in this case named as if it were an alkane, and the other alkyl chain is added as the prefix - alkoxy (eg methoxy, ethoxy etc.)

Esters have an oxygen as a bridge between a carbonyl group and an alkyl group. R-COO-R'. This carbonyl group with the oxygen makes up the ester linkage, -COO-.

Ethers have a bridging oxygen atom between two alkyl chains. The root name is taken from the longest carbon chain, which is named as an alkane, with the shorter of the two chains being a prefix terminating in -oxy.

Essentially the ethers are described as a alkoxy, group, RO-, attached to a hydrocarbon chain.

Condensed structures and names of the ethers		
CH_3OCH_3	$CH_3CH_2OCH_2CH_3$	$CH_3OCH_2CH_3$
methoxymethane	ethoxyethane	methoxyethane

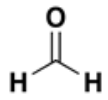
Ethers are used as volatile organic solvents.

Ethoxyethane has the trival name 'ether' or 'diethyl ether', both of which are in common usage.

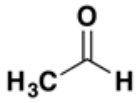
Summary of Aldehyde Nomenclature rules

1. Aldehydes take their name from their parent alkane chains. The -e is removed from the end and is replaced with -al.

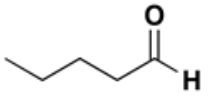
2. The aldehyde funtional group is given the #1 numbering location and this number is not included in the name.



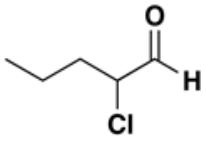
methanal
(formaldehyde)



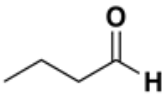
ethanal
(acetaldehyde)



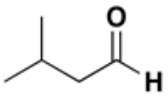
pentanal
(valeraldehyde)



2-chloropentanal
(a-chlorovaleraldehyde)



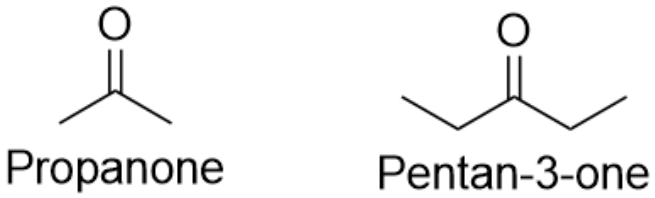
butanal
(butyraldehyde)



3-methylbutanal
(isovaleraldehyde)

Summary of Ketone Nomenclature rules

1. Ketones take their name from their parent alkane chains. The ending -e is removed and replaced with the carbonyl's position # and -one.



In condensed structure, an aldehyde group is represented as –CHO; a ketone is represented as –C(O)– or –CO–.

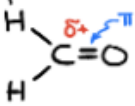
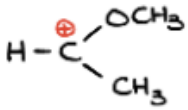
Create a chart that includes

NUCLEOPHILES vs ELECTROPHILES

"Nucleous loving" species
- typically have a ⊖ charge
  or
- non-bonding ē pair available for making a new bond

Examples: $CH_3O^{\ominus}$ or CH_3NH_2

"Electron loving" species
- typically have an atom with a ⊕ charge
  or
- have an Electron Withdrawing Group (EWG) that puts a $\delta+$ on an atom
  or
- have a polarizable π bond

Examples:  or 

Typical Examples of Electrophiles & Nucleophiles

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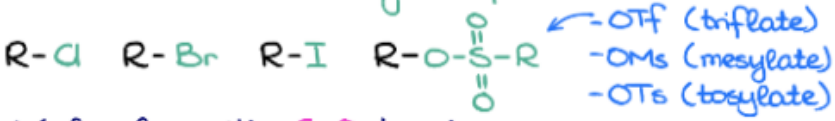
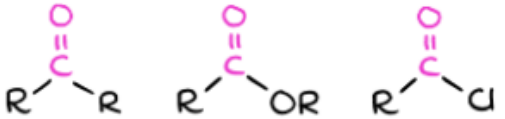
ELECTROPHILES

1. Molecules with Leaving Groups



2. Molecules with C=O bond



etc...

NUCLEOPHILES

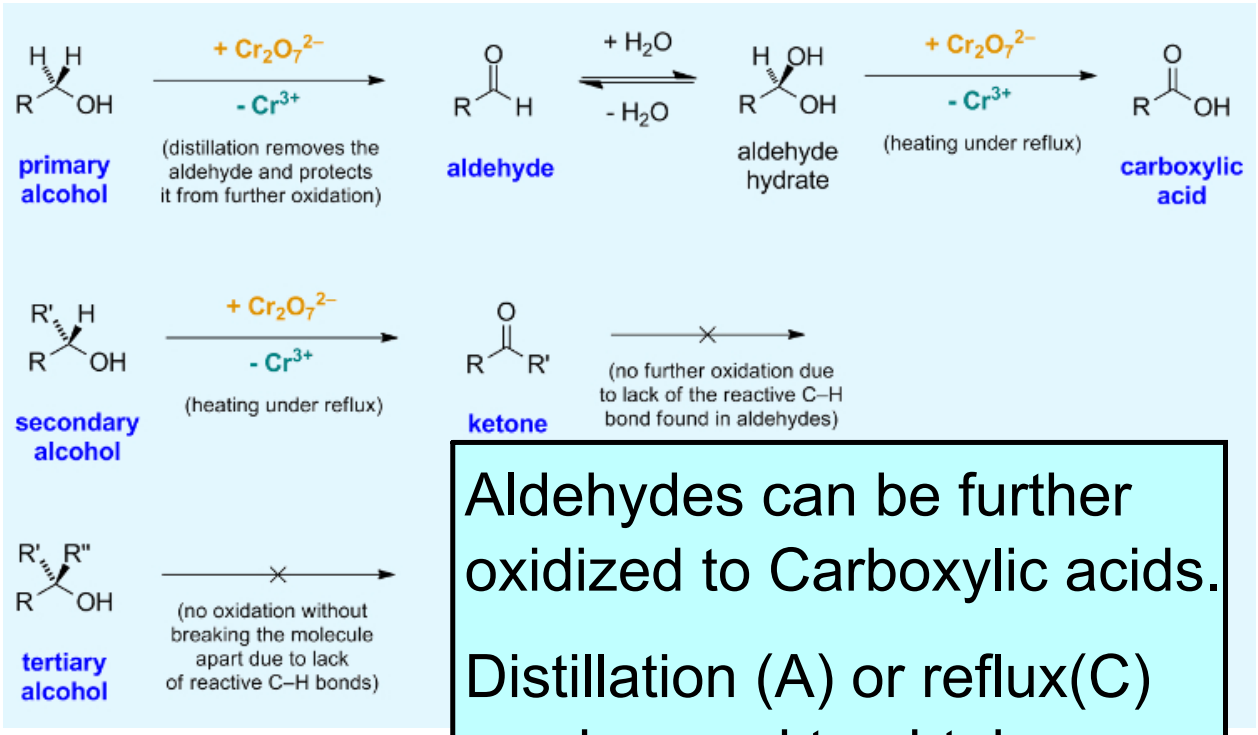
1. Not bulky ⊖-charged ions

$CH_3O^{\ominus}$ $CH_3CH_2^{\ominus}$ $CN^{\ominus}$ $Br^{\ominus}$ etc...

2. Molecules with neutral N, P, or S

H_3N Ph_3P $(CH_3)_2S$ etc...

Oxidation of Alcohols by MnO_4^- or $Cr_2o_7^{2-}$



Aldehydes can be further oxidized to Carboxylic acids.

Distillation (A) or reflux(C) can be used to obtain a single product

MnO_4^- deep violet

Mn^{2+} VERY light pink

$Cr_2O_7^{2-}$ orange

Cr^{3+} green