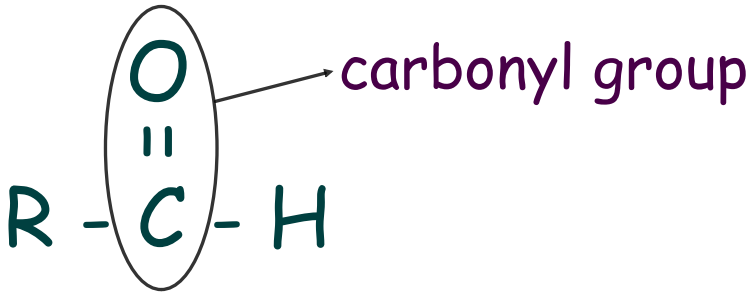
Carbonyl Compounds

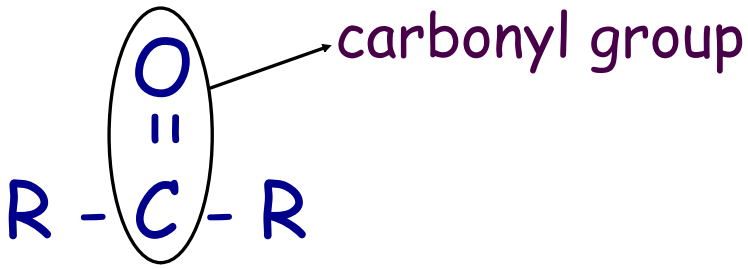
Aldehydes and Ketones

A carbonyl group is a functional group with the general structure C=O. This is present in all aldehydes and ketones.

An aldehyde is an organic compound in which the carbon of the carbonyl group is always joined to at least one hydrogen.



A ketone is an organic compound in which the carbon of the carbonyl group is joined to two other carbons.



The IUPAC naming system can be used for aldehydes and ketones.

- First, identify the longest hydrocarbon chain that contains the carbonyl group
  - For aldehydes, replace the 'e' ending with a 'al'.
  - For ketones, replace the 'e' ending to a 'one'

Table 23.4 on page 738 has some common aldehydes and ketones.

Properties

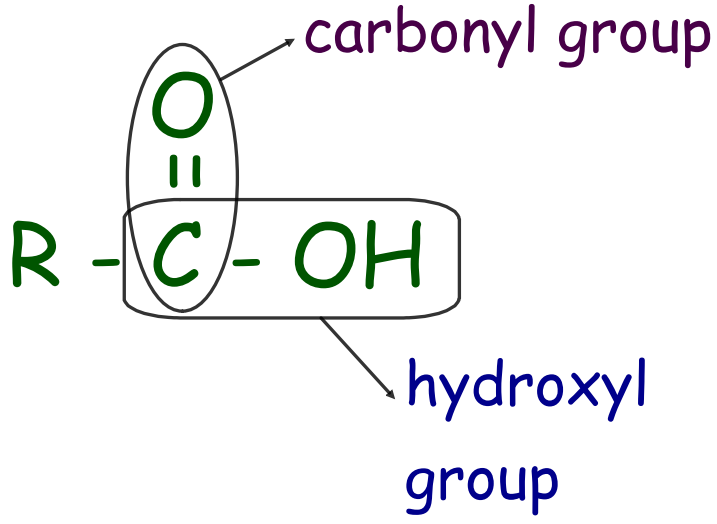
Many aldehydes and ketones have been isolated from plants and animals. Many of them, particularly those with high molar masses, have fragrant or penetrating odors.

Benzaldehyde is the simplest aromatic aldehyde. It is a constituent of almonds and gives off a pleasant almond odor.

The most common ketone is propanone (acetone). It is a colorless volatile liquid that is often found in nail-polish removers.

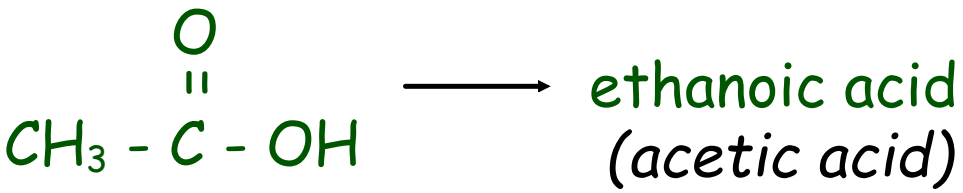
Carboxylic Acids

A carboxylic acid is a compound with a carboxyl group. A carboxyl group consists of a carbonyl group attached to a hydroxyl group.



Remember that when dissolved in water acids will produce a H^+ ion. These are no different.

In the IUPAC naming system, carboxylic acids are named by replacing the 'e' ending with the ending 'oic acid'



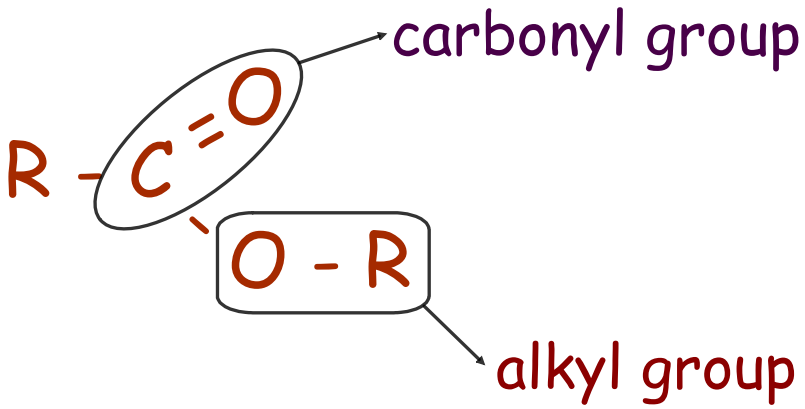
Common household vinegar contains about 5% acetic acid. In general, most aliphatic carboxylic acids have unpleasant odors. The higher carbon chains become less volatile, odorless solids.

Carbonyl Compound Worksheet

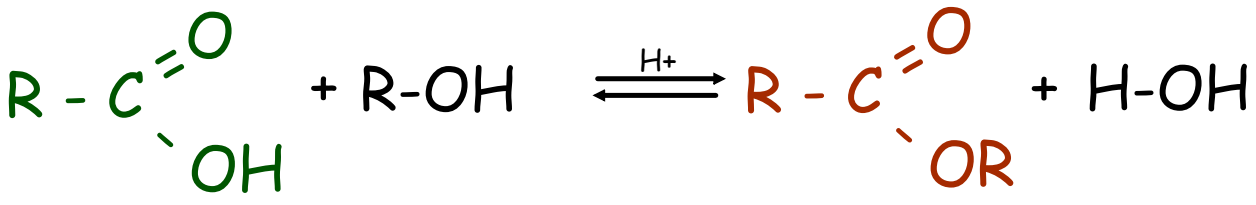
Esters

Esters are known for their pleasant aromas. They give blueberries and pineapples their characteristic aromas.

Esters contain a carbonyl group and an ether link to the carbonyl carbon.



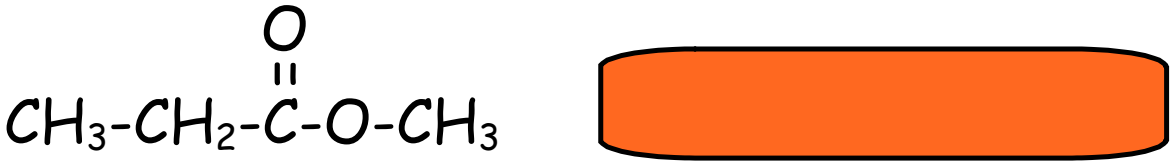
Ester can be prepared from carboxylic acids and alcohols. The reaction is reversible.

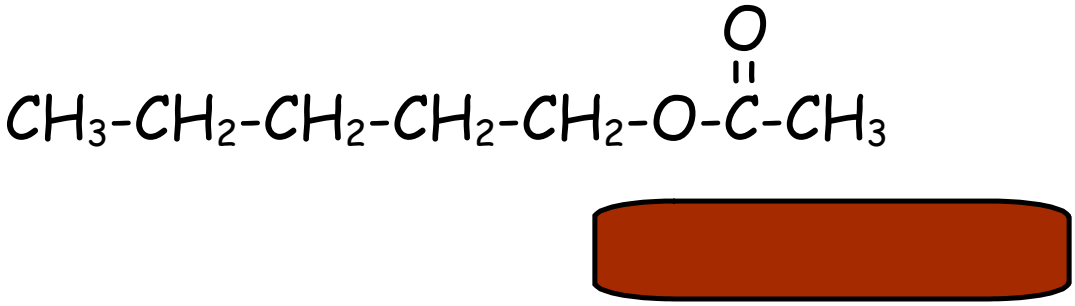


carboxylic acid *alcohol* *ester* *water*

In naming esters, remove the 'e' ending and replace it with 'oate'. The parent chain is attached to the carbonyl. The branch chain is attached to the alcohol.

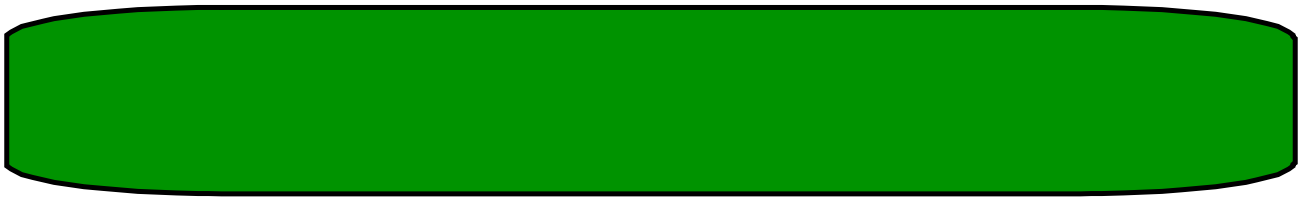
Examples:





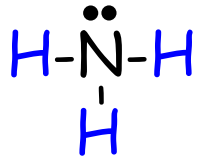
Practice

Try to draw the ester butylhexanoate

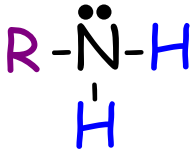


Amines

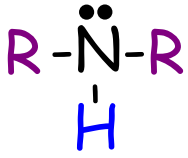
When naming amines, the compound structure has at least one carbon chain attached to a nitrogen.



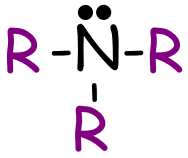
Ammonia (not an amine)



1st degree amine (1°)



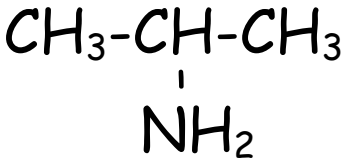
2nd degree amine (2°)



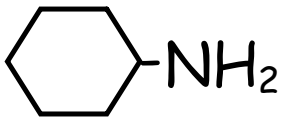
3rd degree amine (3°)

As an intro, we will only be looking at 1st degree amines. Amines are found in medicines that relieve pain (Morphine, Demerol) as well as anesthetics (Novocaine) and dyes.

To name them, we drop the 'e' ending and add in 'amine'. All previous naming structures apply.



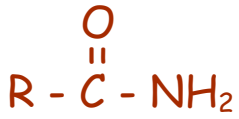
What do you think this one would be?



Practice

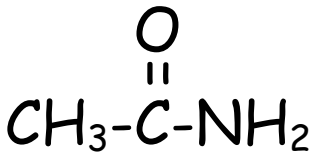
What would be the structure for 4-methyl-2-pentanamine?

Amides

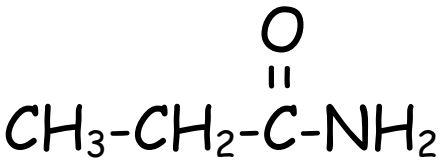
Amides have a carbonyl group attached to the compound structure. They take the shape  and can be used to form resilient structural materials like nylon and kevlar.

The naming system is similar to that of amines. There are also 1st,2nd, and 3rd degree amides. We will just be looking at 1st degree.

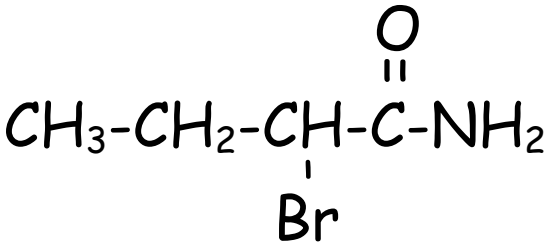
Examples:

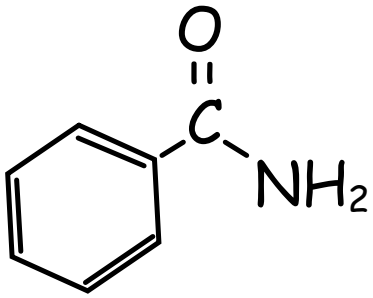


ethanamide



propanamide





Lab Safety Procedures

Esters, Amines, and Amides Worksheet