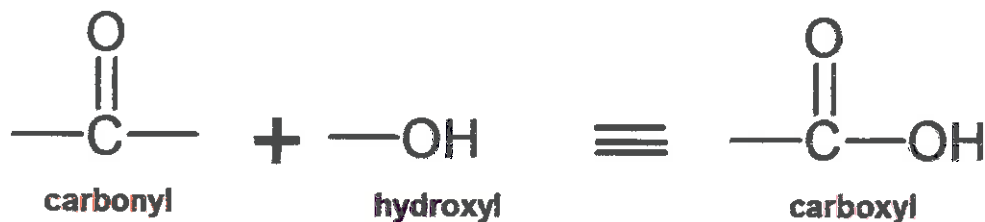


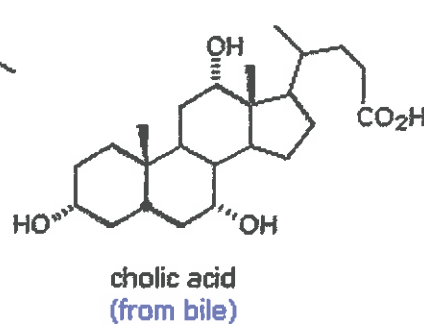
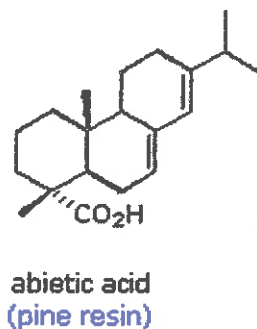
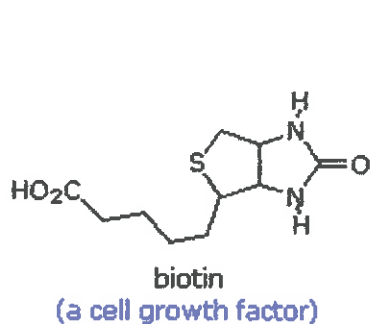
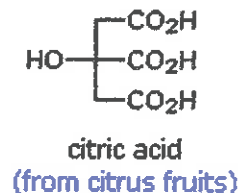
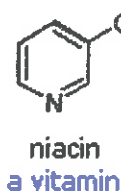
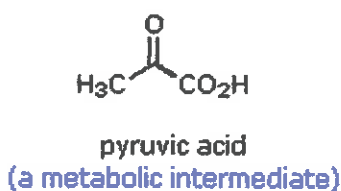
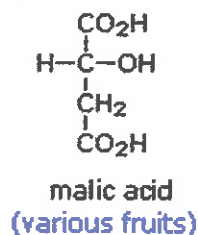
7.0 Carboxyl Acids, Esters, & Fats

Carboxyl Acids

A carboxyl group is a carbon atom that is double-bonded to one oxygen atom and single-bonded to a hydroxyl group. It is often written in condensed form as $-\text{CO}_2\text{H}$ or $-\text{COOH}$.

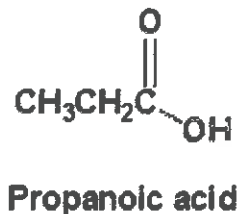
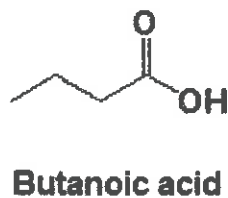


A carboxylic acid is a weak organic acid containing at least one carboxyl group.

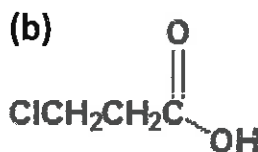
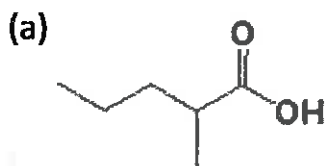


Naming Carboxyl Acids

- Use the suffix -oic acid
- Number the parent chain so that the carboxyl group is on carbon one



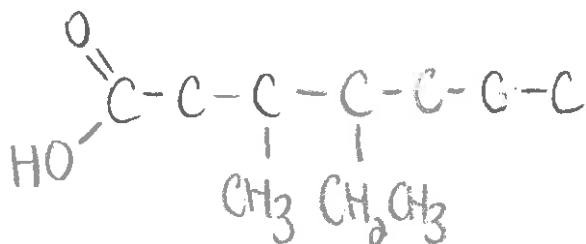
Examples: Name the following.



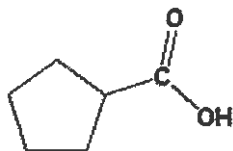
2-Methylpentanoic acid

3-Chloropropanoic acid

Example: Draw 4-ethyl-3-methylheptanoic acid.

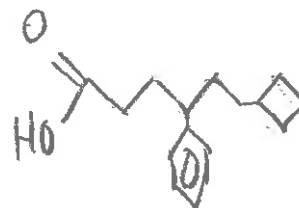
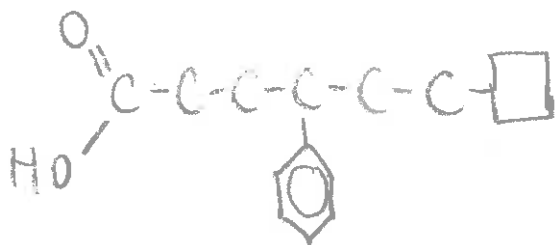


- When a carboxyl group is added to a ring the suffix -carboxylic acid is added to the name of the cyclic compound. The ring carbon attached to the carboxyl group is given the #1 location number.

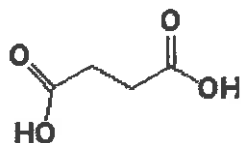


Cyclopentanecarboxylic acid

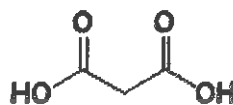
Example: Draw 4-phenyl-6-cyclobutylhexanoic acid.



- If an acid has two carboxyl groups use the suffix -dioic acid. The location numbers for both carboxyl groups are omitted because both groups are expected to occupy the ends of the parent chain.



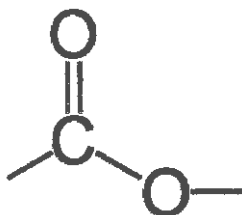
Butanedioic acid



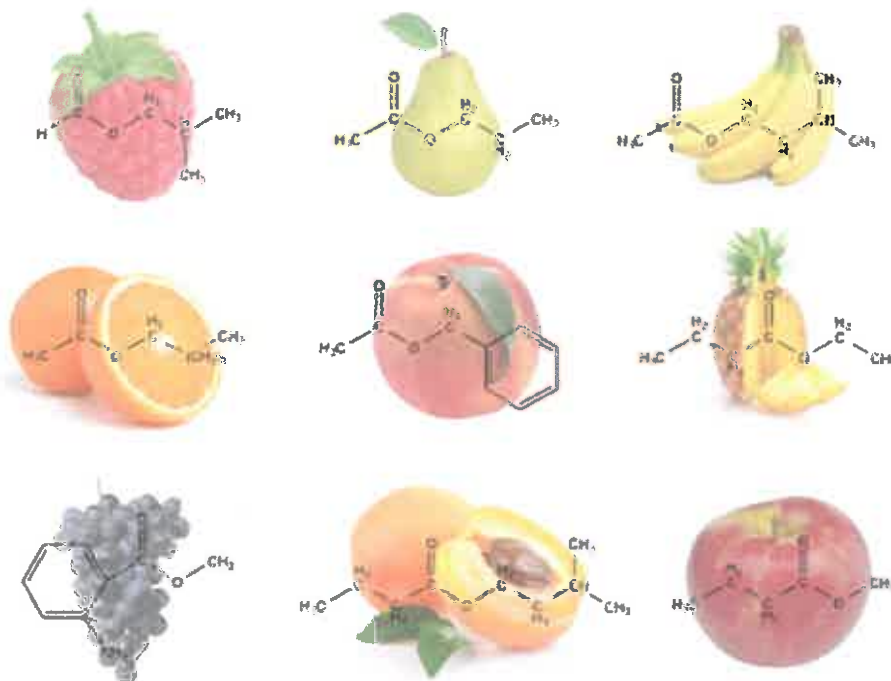
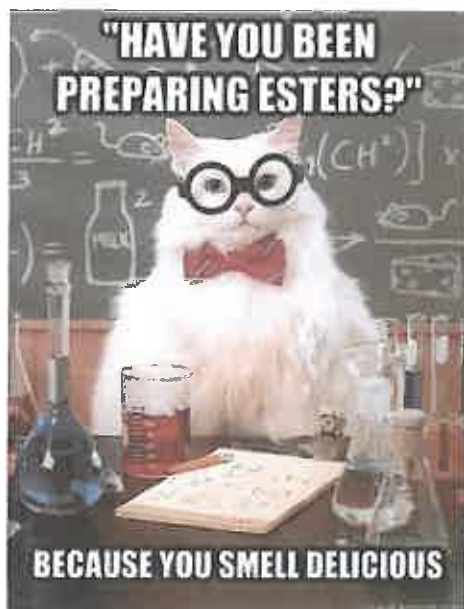
Propanedioic acid

Esters

An ester is an organic compound that contains a carbonyl group bonded to a second oxygen atom which is bonded to another carbon atom. The general formula -COO-

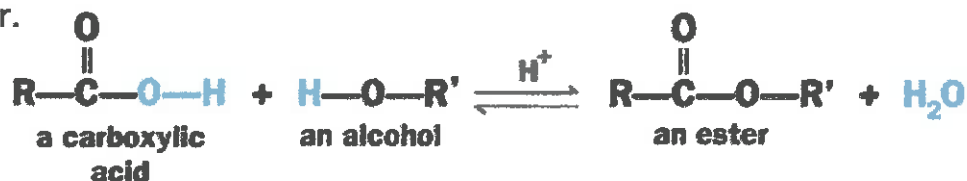


Esters are known for their distinctive odors and are commonly used for food aroma and fragrances.



Esters are formed through reactions between an acid and an alcohol. This process, called esterification, reacts alcohols and carboxylic acids to make esters while eliminating water.

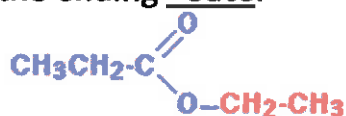
An example of esterification is the reaction of acetic acid with an alcohol, which yields an acetic ester and water.



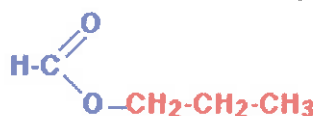
Naming Esters

(Where R and R' are general hydrocarbon groups)

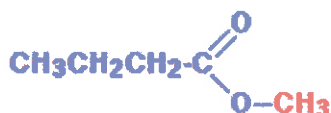
- Named based on the alcohols and acids they are made of.
- Esters are named as if the alkyl chain from the alcohol is a substituent. No number is assigned to this alkyl chain. *(a single bonded O chain)*
- This is followed by the name of the parent chain from the carboxylic acid part of the ester with the ending -oate. *(double bonded O)*



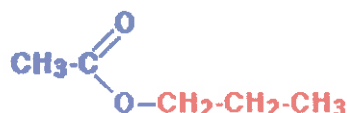
ethyl propanoate



propyl methanoate

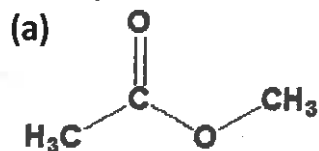


methyl butanoate

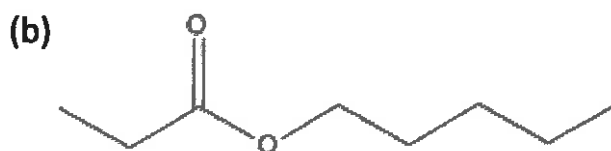


propyl ethanoate

Examples: Name the following.



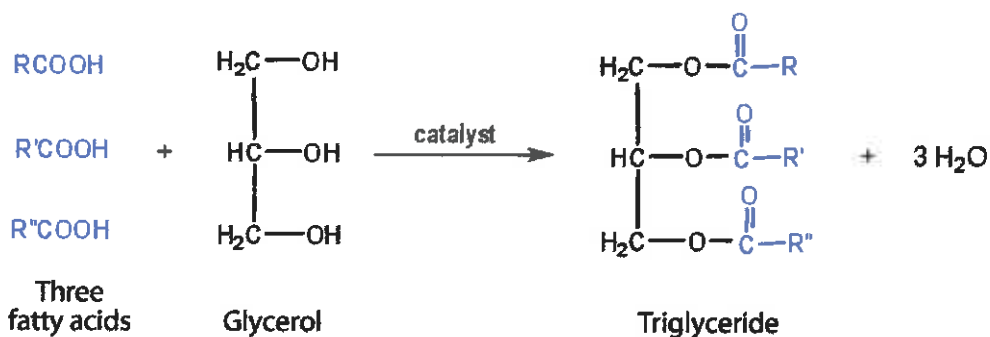
Methyl ethanoate



Pentyl propanoate
Peach

Fats and Oils

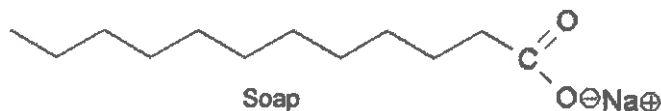
Fats and oils are triglycerides – esters (acids bonded to alcohol) made from long chains of fatty acids. A triglyceride means that three acids are bonded to an alcohol.



Fats are generally solid at room temperature and high in saturated fatty acids. Oils meanwhile are generally liquid at room temperature and low in saturated fatty acids.

Saponification

Fats and oils can be heated in the presence of a strong base to make soap (sodium or potassium salts of fatty acids). This process is called saponification.



Essentially, saponification is a reverse esterification. Esters can be cleaved back into a carboxylic acid and an alcohol by reaction with water and a base.

