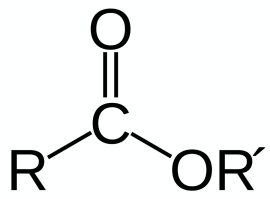
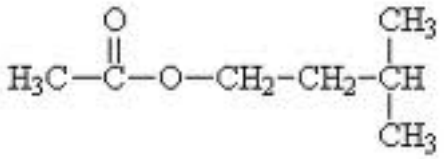
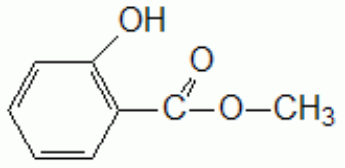
Esters

An **ester** is similar to a carboxylic acid, but has a hydrocarbon group in place of the hydrogen atom of the carboxyl group. The general formula for an ester is



where R represents the parent chain, and R' represents the hydrocarbon group that replaced the hydrogen in the carboxyl group.

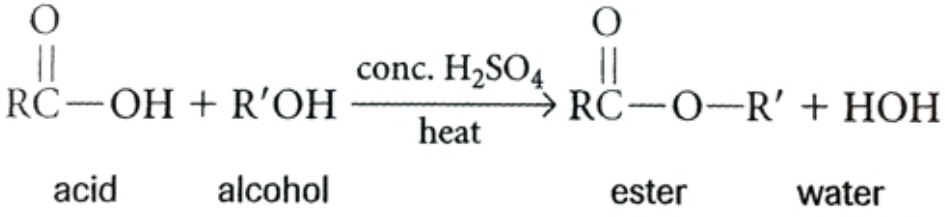
Esters occur naturally in many plants and are responsible for the odors of fruits and flowers. Synthetic esters are often added as flavorings to processed foods, and as scents to cosmetics and perfumes. The table below shows the main esters used to create certain artificial flavors.

Odor	**Name**	**Formula**
apple	methyl butanoate	$CH_3CH_2CH_2COOCH_3$
apricot	pentyl butanoate	$CH_3CH_2CH_2COOCH_2CH_2CH_2CH_2CH_3$
banana	3-methylbutyl ethanoate	
cherry	ethyl benzoate	$C_6H_5COOC_2H_5$
orange	octyl ethanoate	$CH_3COOCH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$
pineapple	ethyl butanoate	$CH_3CH_2CH_2COOCH_2CH_3$
red grape	ethyl heptanoate	$CH_3CH_2CH_2CH_2CH_2CH_2COOCH_2CH_3$
rum	ethyl methanoate	$HCOOCH_2CH_3$
wintergreen	methyl salicylate	

Esterification

When a carboxylic acid (*RCOOH*) reacts with an alcohol (*R′OH*), the products that result are an ester and water. This condensation reaction is known as **esterification**.

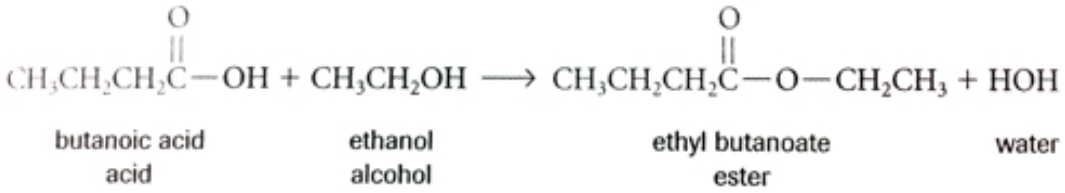
The general reaction between a carboxylic acid and an alcohol is represented below.



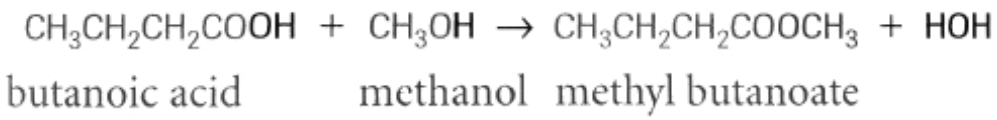
An acid catalyst, such as sulfuric acid, and heat are generally required for this reaction to proceed. It is interesting to note that, in this reaction, the acid donates its $-OH$ group while the alcohol donates a single hydrogen to form the water molecule.

Naming Esters

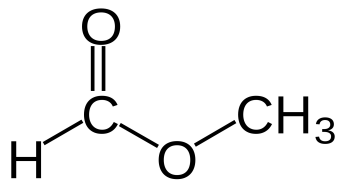
The name of an ester has two parts. The first part is the name of the alkyl group from the alcohol used in the esterification reaction. The second part comes from the acid. The ending of the acid name is changed from *–oic* to *–oate*. For example, in the reaction of ethanol and butanoic acid, the ester formed is ethyl butanoate, an ester with a banana odor.



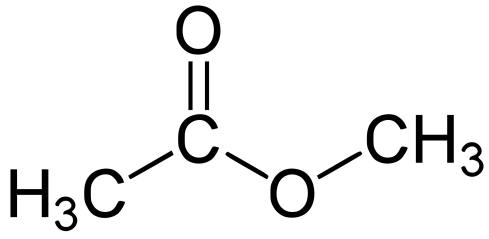
Note that, for an ester, the acid is the first part of its formula drawn but is the second part of its name.



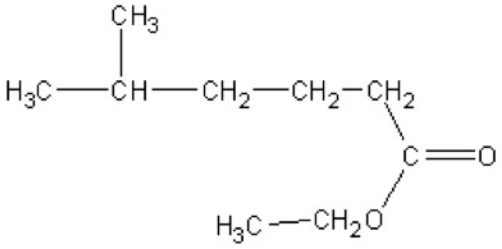
Example 1
Name the ester shown below.



Example 2
Name the ester shown below.



Example 3
Name the ester shown below.



Example 4
Draw the ester whose name is 2-methylpropyl-3-methylbutanoate.

Example 5
Write the reaction, showing structures, for the reaction that produces ethyl heptanoate. Indicate the conditions necessary for the reaction to occur.