

Unit 5

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Chapter 10

Naming and Preparing Esters

This Audio Clip is intended to provide you with some helpful tips and generalizations regarding the esterification process.

Look at the general formula for an ester in the Learning Tip on page 439. Remember that the “R” groups essentially represent the rest of the molecule, so they are the variable parts of the molecular compound. What makes an ester an ester is the carbonyl group bonded to the oxygen. The other parts of the molecule are on either side of this –COO– functional group. Laboratory research has shown that esters are formed by condensation reactions in which a carboxylic acid reacts with an alcohol. The products are found to be an ester and water, the latter product explaining the term “condensation.” The side of the ester molecule with the carbonyl (CO) group originally came from the acid while the other side of the molecule, attached to the oxygen, came from the alcohol. This is important to remember when you are naming an ester.

Consider Sample Problem 10.6: Given the condensed structural formula of the ester you are asked to determine condensed structural formulas, as well as the IUPAC names, of the reactants. As a general rule, the part of the ester (or R group) that came from the acid—the part with the CO group—is written on the left side of the ester functional group. The part that came from the alcohol—the part attached to the oxygen atom—is written on the right side of the COO ester functional group. Look carefully at the condensed structural formula of the ester in this question. The acid would have had four carbons and was therefore a butanoic acid molecule. The alcohol had two carbons and was therefore an ethanol molecule. Draw the condensed structural formulas for these two reactants with the IUPAC names below the formulas. Now draw the condensed structural formula of the ester and water as the products.

To name the ester, name the original alcohol as an alkyl group. *Ethyl* is therefore the first word in the name of this ester. The second word is derived from the original carboxylic acid, but the ending changes from “-oic acid” to “-oate”. *Butanoate* is therefore the second word in the name of this ester. The ester in this reaction is called *ethyl butanoate* and has the odour of pineapple.

Chemists have found that a strong acid is needed as a catalyst in esterification reactions, so indicate this by writing “acid” or $\text{H}_2\text{SO}_4(\text{aq})$ [the formula for sulfuric acid] on the reaction arrow. Remember the catalyst speeds up the reaction but is not a reactant in the process.

Note that the empirical work in the laboratory is paralleled by theoretical work to explain the laboratory findings. Empiricists and theoreticians work closely together to advance both forms of chemical knowledge.