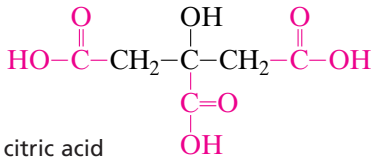
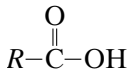


citric acid

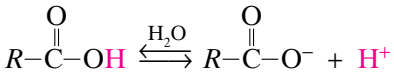
FIGURE 15 Citric acid, found in citrus fruits, contains three carboxylic acid groups shown in red on the structural formula.

Carboxylic Acids

Carboxylic acids *are organic compounds that contain the carboxyl functional group.* A member of this class of organic compounds can be represented by the general formula shown below.



Carboxylic acids, like inorganic acids, react to lose a hydrogen ion and become a negatively charged ion in water.

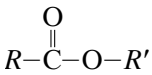


Carboxylic acids are much weaker than many inorganic acids, such as hydrochloric, sulfuric, and nitric acids. Acetic acid, the weak acid in vinegar, is a carboxylic acid.

A number of carboxylic acids occur naturally in plants and animals. For example, citrus fruits, shown in **Figure 15,** contain citric acid. Benzoic, propanoic, and sorbic acids are used as preservatives. All three acids kill microorganisms that cause foods to spoil.

Esters

Esters *are organic compounds that have carboxylic acid groups in which the hydrogen of the hydroxyl group has been replaced by an alkyl group.* Esters are considered *derivatives* of carboxylic acids because of their structural similarity to carboxylic acids. The general formula for an ester is given below.



SECTION REVIEW

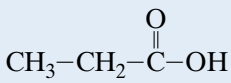
1. Give the general formula and class of organic compounds for each of the following:

a. CH_3-OH

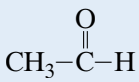
b. CH_3-O-CH_3

c. $Br-CH_2-CH_2-CH_3$

d.

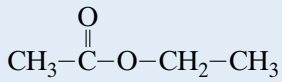


e.

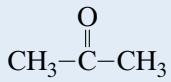


f. $CH_3-CH_2-NH_2$

g.



h.



2. Compare the boiling points of alcohols, ethers, and alkanes, and explain one reason for the differences.

3. How are aldehydes and ketones alike? How do they differ?

4. How do the strengths of organic acids compare with the strengths of most inorganic acids?

Critical Thinking

5. **APPLYING MODELS** Identify the functional groups in vanillin, shown in Figure 14.