

## 6.7: REACTIONS OF CARBOXYLIC ACIDS - AN OVERVIEW

### OBJECTIVES

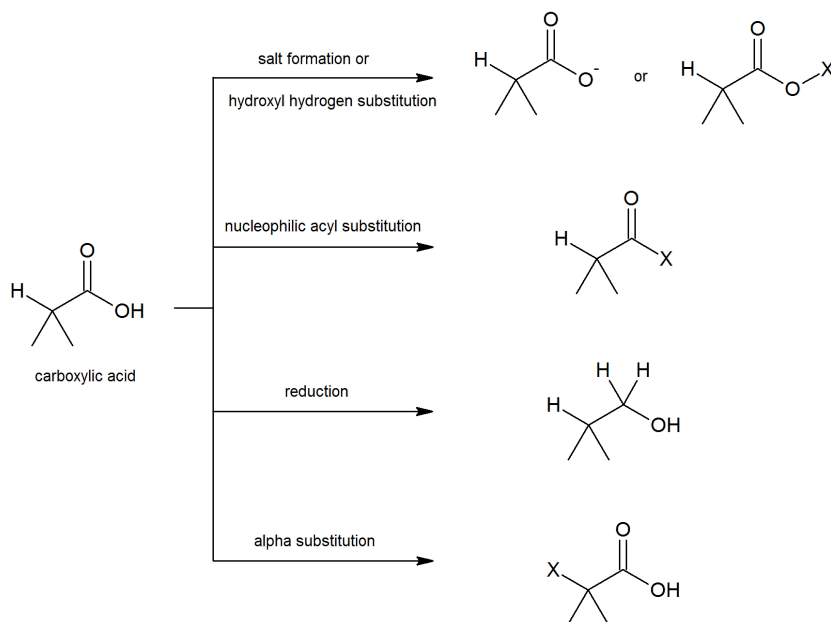
After completing this section, you should be able to identify the four types of reaction which a carboxylic acid can undergo.

### STUDY NOTES

You may wish to review Section 17.4 which discusses reduction of carbonyl compounds to form alcohols and Sections 20.2–20.4 which highlights the acidity of carboxylic acids, which is important to salt formation and substitution of the hydroxyl hydrogen. Nucleophilic acyl substitution (Chapter 21) and alpha substitutions (Chapter 22) are discussed later in more detail.

### FOUR CATEGORIES OF CARBOXYLIC ACID REACTIONS

Four general reaction categories are represented here: (1) As carboxylic acids are easily deprotonated, they readily form a carboxylate salt which can then potentially be reacted with an electrophile to complete a substitution of the hydroxyl hydrogen. (2) Nucleophilic acyl substitution reactions allow substitution of the hydroxyl group which leads to several carboxylic acid derivatives (e.g. acid halides, esters, amides, thioesters, acid anhydrides etc.). We will see these reactions in more detail in Chapter 21. (3) Like other carbonyl compounds, carboxylic acids can be reduced by reagents such as  $\text{LiAlH}_4$ . (4) While the proton on the carbon alpha to the carbonyl group is not as acidic as the hydroxyl hydrogen, it can be removed leading to substitution at the alpha position. The scheme summarizes some of the general reactions that carboxylic acids undergo.

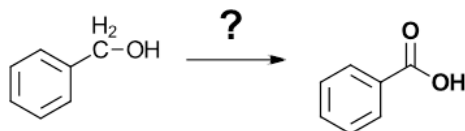


Four general reaction categories are represented here: (1) As carboxylic acid deprotonates quite readily, it is quite easy to form a carboxylate salt or to substitute the hydroxyl hydrogen. (2) The category of nucleophilic acyl substitution represents the substitution of the whole hydroxyl group, which we will see later in more detail leads to several carboxylic acid derivatives (e.g. acid halides, esters, amides, thioesters, acid anhydrides etc.). (3) Like other carbonyl compounds, carboxylic acids can be reduced by reagents like  $\text{LiAlH}_4$ . (4) While the proton on the carbon alpha to the carbonyl group is not as acidic as the hydroxyl hydrogen, it can be removed leading to substitution at the alpha position.

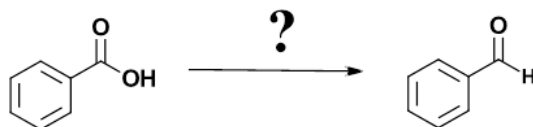
### EXERCISES

1) Show how the following transformations can be performed. Multiple steps may be required.

a)



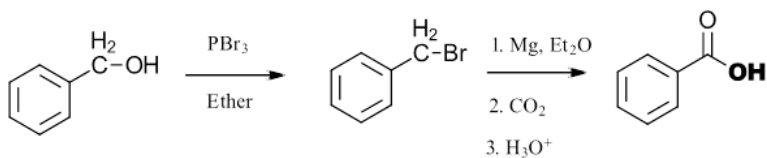
b)



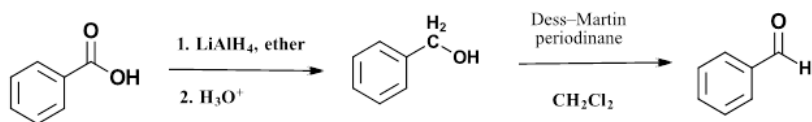
## SOLUTIONS

1)

a)



b)



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