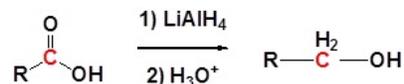


## 21.9: REDUCTION OF CARBOXYLIC ACIDS

### CARBOXYLIC ACIDS CAN BE CONVERTED TO 1° ALCOHOLS USING LITHIUM ALUMINUM HYDRIDE (LiAlH<sub>4</sub>)

Note that NaBH<sub>4</sub> is not strong enough to convert carboxylic acids or esters to alcohols. An aldehyde is produced as an intermediate during this reaction, but it cannot be isolated because it is more reactive than the original carboxylic acid.



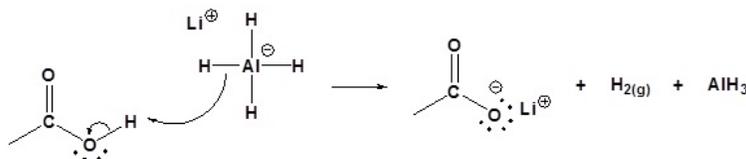
For example, butanoic acid can be reduced to butanol when reacted with lithium aluminum hydride as shown below.



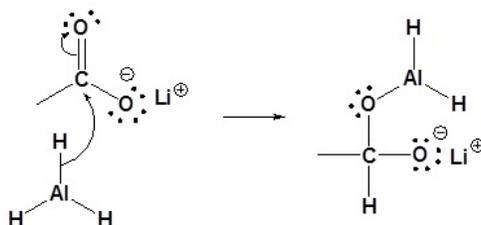
### POSSIBLE MECHANISM

There is not complete agreement on the mechanism for this reaction. However, the mechanism below is considered probable by many chemists.

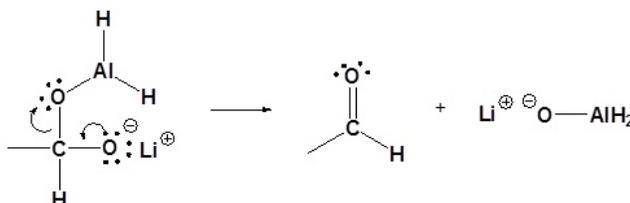
1) Deprotonation



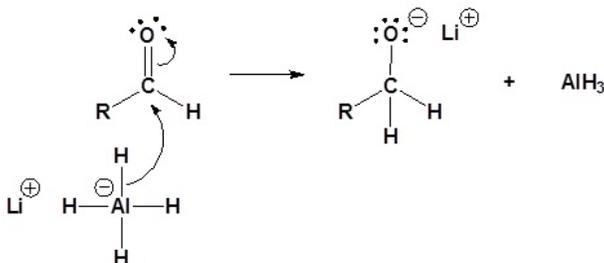
2) Nucleophilic reaction by the hydride anion



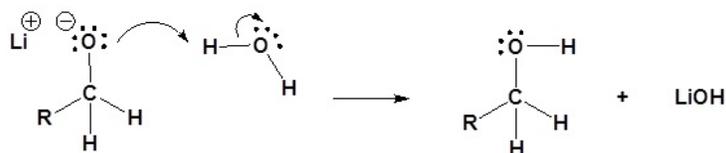
3) Leaving group removal



4) Nucleophilic reaction by the hydride anion



5) The alkoxide is protonated

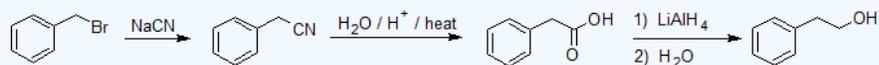


### Exercise

8. Using benzyl bromide and sodium cyanide as the only source of carbons, propose a synthetic strategy to produce 2-phenyl-ethan-1-ol.

Answer

8.



### CONTRIBUTORS AND ATTRIBUTIONS

- Dr. Dietmar Kennepohl FCIC (Professor of Chemistry, [Athabasca University](#))
- Prof. Steven Farmer ([Sonoma State University](#))

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