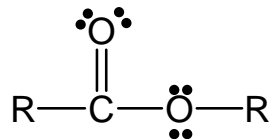


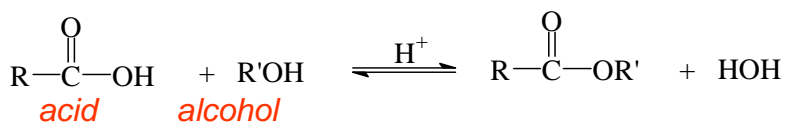
## Fischer Esterification

Ester – acid derivative in which  
OH group has been replaced  
by OR



Can be prepared by several methods...

- Acid chloride + alcohol
- Acid salt + 3° halide
- Carboxylic acid + diazomethane
- Carboxylic acid + alcohol (Fischer Esterification)



## Ester Equilibria

Fischer esterification is a reversible equilibrium...



governed by the equilibrium expression...

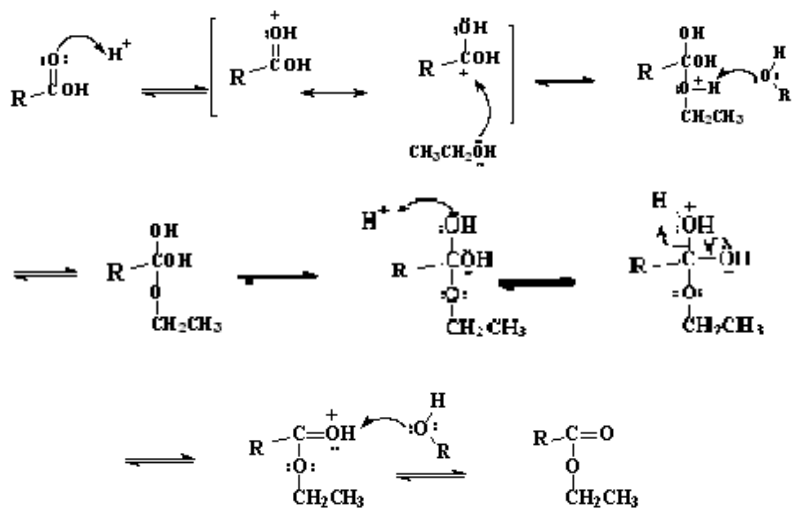
$$K_{eq} = \frac{[\textit{ester}][\textit{water}]}{[\textit{acid}][\textit{alcohol}]}$$

$K_{eq}$  for this reaction is typically  $> 1$ , so the products are favored...

but  $K_{eq}$  is not very large, so complete conversion is not attained... without help.

## Mechanism of Fischer Esterification

Reaction is promoted by acid, which activates the acid carbonyl



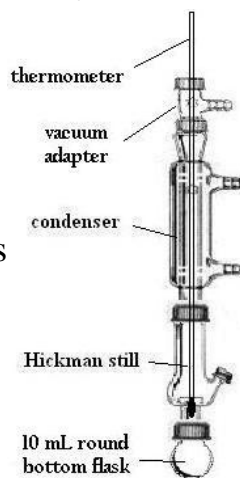
There are two variations of this reaction in the lab text...

Expt 22 entails a microscale preparation only

- It utilizes a “normal” microscale distillation such as that at right...

Expt 23 involves a determination of  $K_{eq}$  of the reaction, followed by the isolation, purification, & analysis of an ester

- It uses a simple macroscale reflux apparatus followed by combination with a water trap as shown on the next slide.



## Dean-Stark Water Separator

Although  $K_{eq}$  favors formation of the ester, complete conversion requires the use of Le Chatelier's principle to "fool" the reaction into going towards completion. This is done by removing the ester/water azeotrope via a side-arm water trap.

