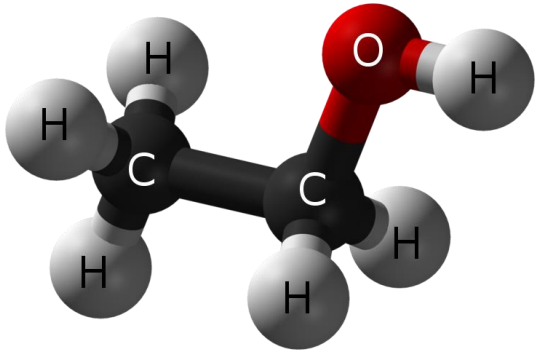
2302106 – Basic Organic Chemistry for ISE – Part II

Lecture 2-2

Alcohols – Alcohols as Nucleophiles



Instructor: Asst. Prof. Dr. Tanatorn Khotavivattana
E-mail: tanatorn.k@chula.ac.th

Recommended Textbook:

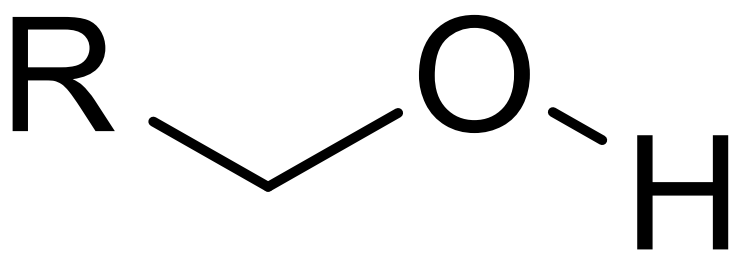
Chapter 10 and 11 in *Organic Chemistry*, 8th Edition, L. G. Wade, Jr., **2010**, Prentice Hall (Pearson Education)

Reaction of Alcohols

Key Ideas: **1) O of hydroxy group is a (poor) nucleophile**

2) H of hydroxy group is (weakly) acidic

3) OH is a (poor) leaving group -> (poor) electrophile



Reaction of Alcohols

1) H of hydroxy group is (weakly) acidic

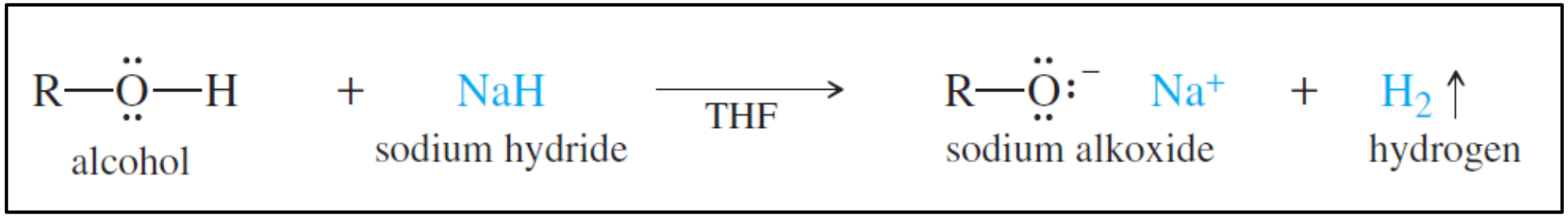
Alcohol in water:

Reaction with NaOH (or weaker bases):

Reaction of Alcohols

1) H of hydroxy group is (weakly) acidic

The **hydroxyl proton** can be removed from an alcohol by reaction with **strong base (such as NaH)**



Generates a sodium or potassium salt of an **alkoxide** ion and hydrogen gas

Reaction of Alcohols: Alcohols as Nucleophiles

Reaction with strong electrophile:

Reaction with weak electrophile:

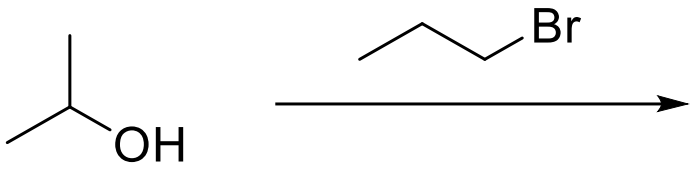
BASE .....

Reaction of Alcohols: Alcohols as Nucleophiles

Reaction with alkyl halides (weak electrophile)

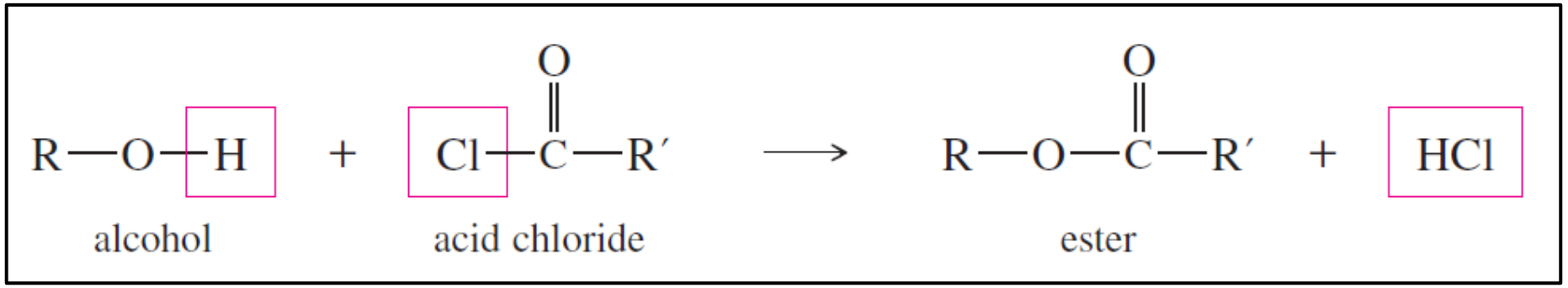
Reaction of Alcohols: Alcohols as Nucleophiles

Example: Predict the product of the following reactions:



Reaction of Alcohols: Alcohols as Nucleophiles

Reaction with acid chlorides (strong electrophile)



Problem Solving

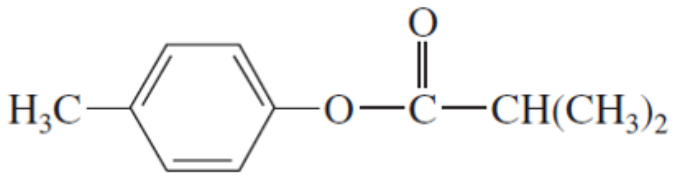
Show the alcohol and the acid chloride that combine to make the following esters.

(a) $CH_3CH_2CH_2\overset{\overset{O}{\|}}{C}-OCH_2CH_2CH_3$

n-propyl butyrate

(b) $CH_3(CH_2)_3-O-\overset{\overset{O}{\|}}{C}-CH_2CH_3$

n-butyl propionate

(c) 

p-tolylisobutyrate

Reaction of Alcohols

Alcohols as Nucleophiles

Example: Predict the product of the following reactions

1)

2)

Reaction of Alcohols: Alcohols as Nucleophiles

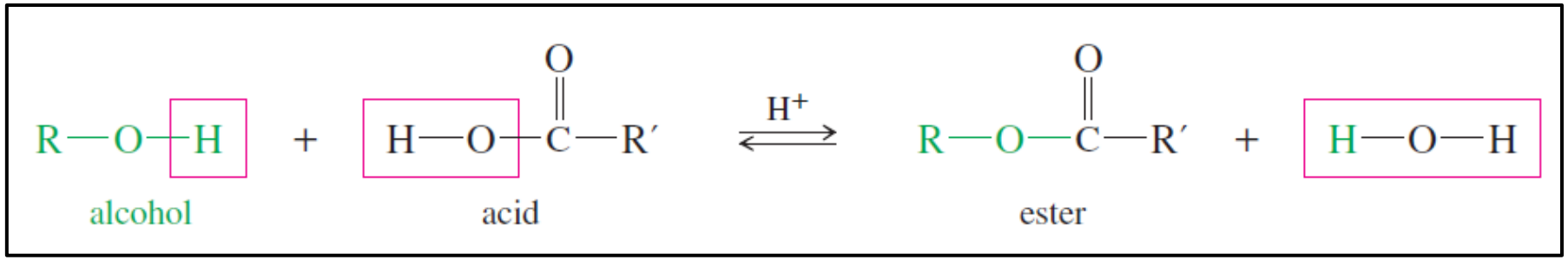
Reaction with carboxylic acids (weak electrophile)

Under basic conditions:

Reaction of Alcohols: Alcohols as Nucleophiles

Reaction with carboxylic acids (weak electrophile)

Under acidic conditions:

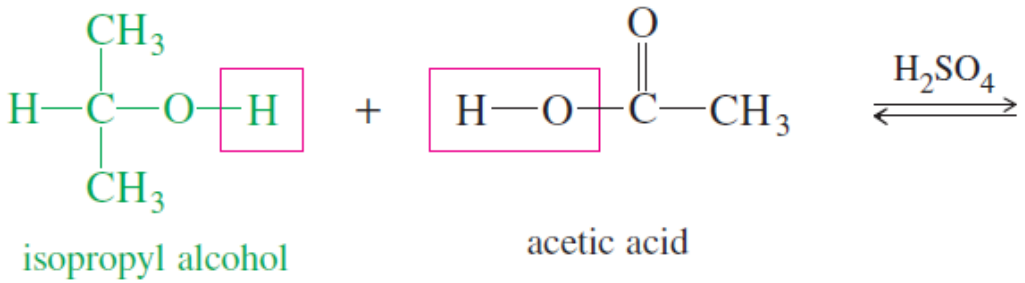


ACID .....

Reaction of Alcohols Alcohols as Nucleophiles

Reaction with carboxylic acids (weak electrophile)

Example



isopropyl alcohol acetic acid

- Equilibrium: To achieve good yield, use a **large excess of the alcohol or the acid** or add a **dehydrating agent** removes water (one of the products),

Reaction of Alcohols Alcohols as Nucleophiles

Reaction with aldehydes/ketones (moderate electrophiles)

Under neutral conditions:

Under basic conditions:

Reaction of Alcohols Alcohols as Nucleophiles

Reaction with aldehydes/ketones (moderate electrophiles)

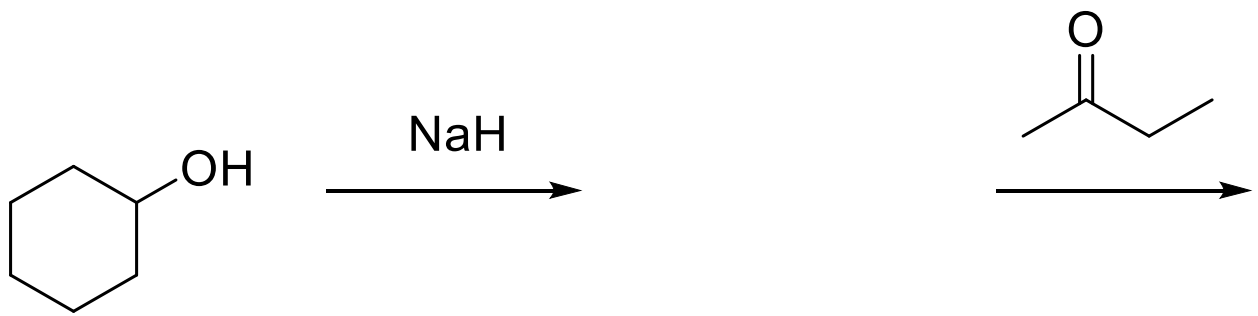
Under acidic conditions:

Reaction of Alcohols

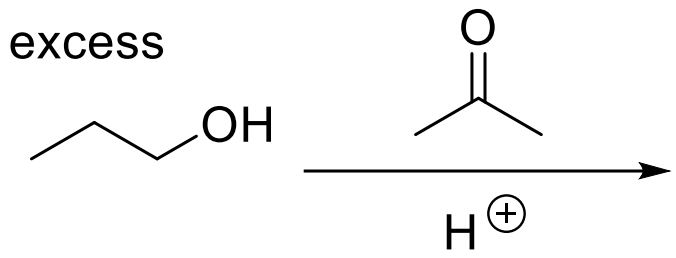
Alcohols as Nucleophiles

Example: Predict the product of the following reactions

1)



2)



Reaction of Alcohols

Alcohols as Nucleophiles