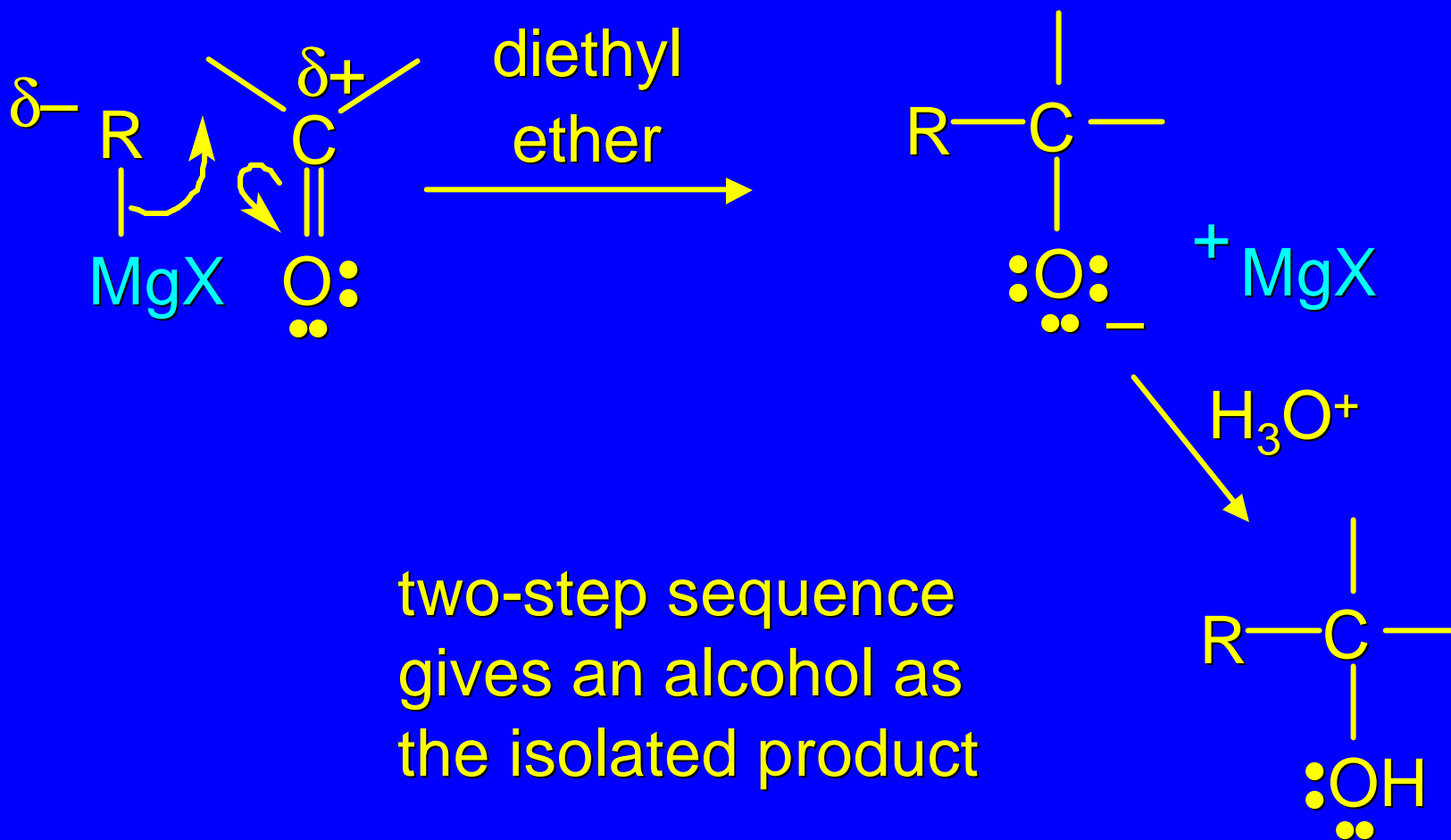


14.6

Synthesis of Alcohols Using
Grignard Reagents

Grignard reagents act as nucleophiles toward the carbonyl group



Grignard reagents react with:

formaldehyde to give primary alcohols

aldehydes to give secondary alcohols

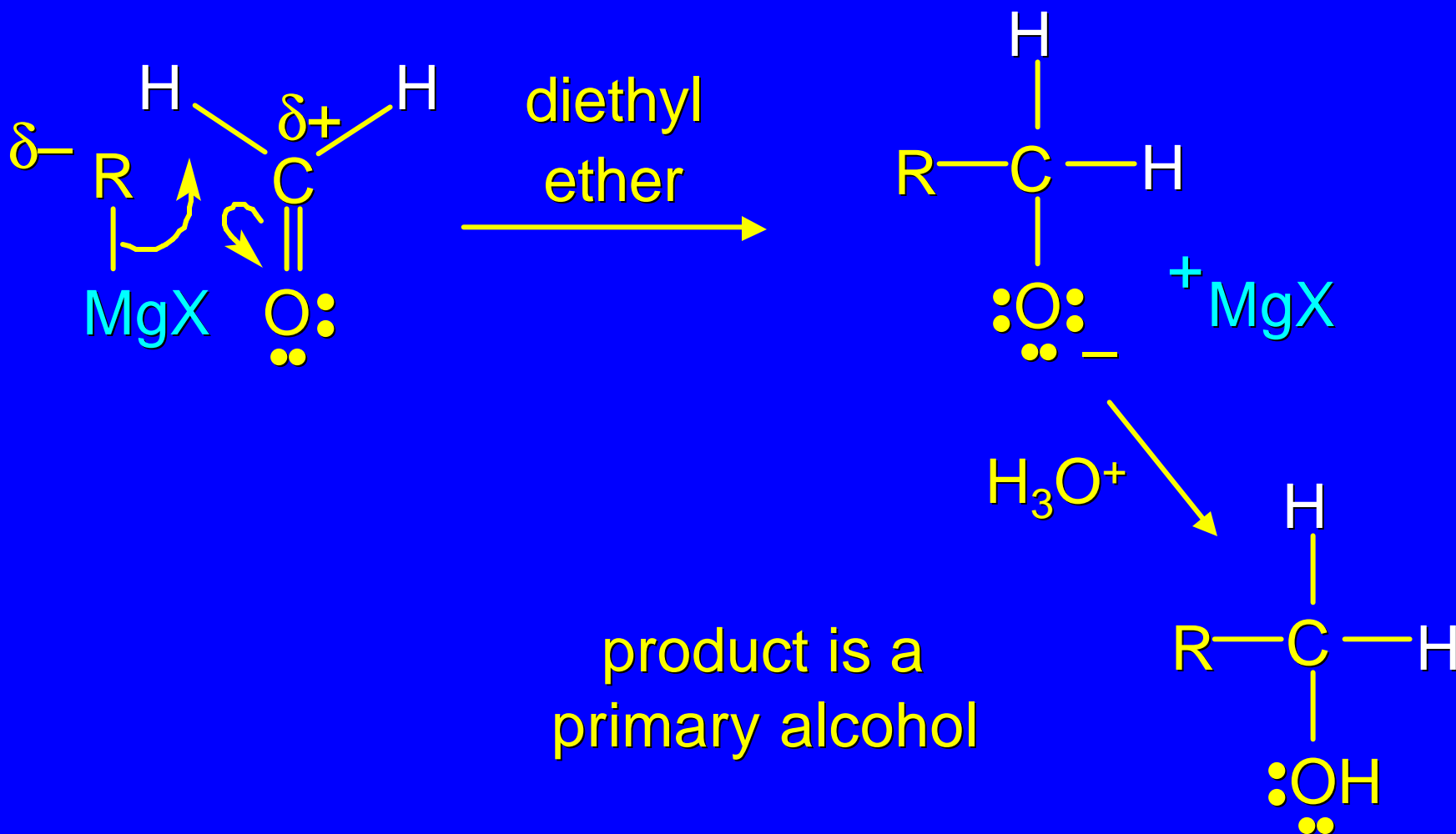
ketones to give tertiary alcohols

esters to give tertiary alcohols

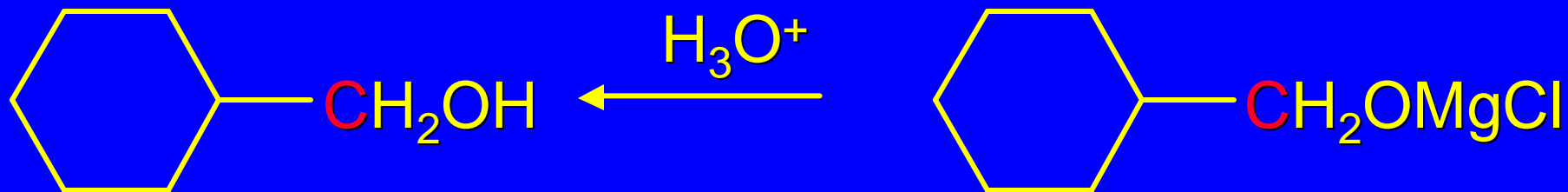
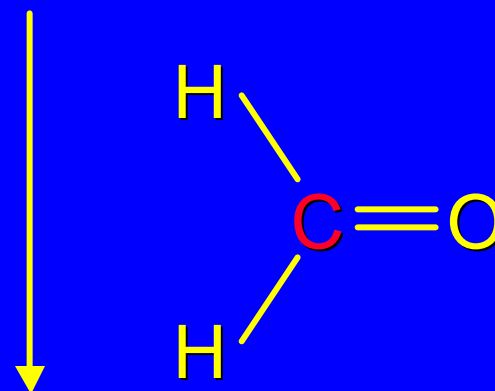
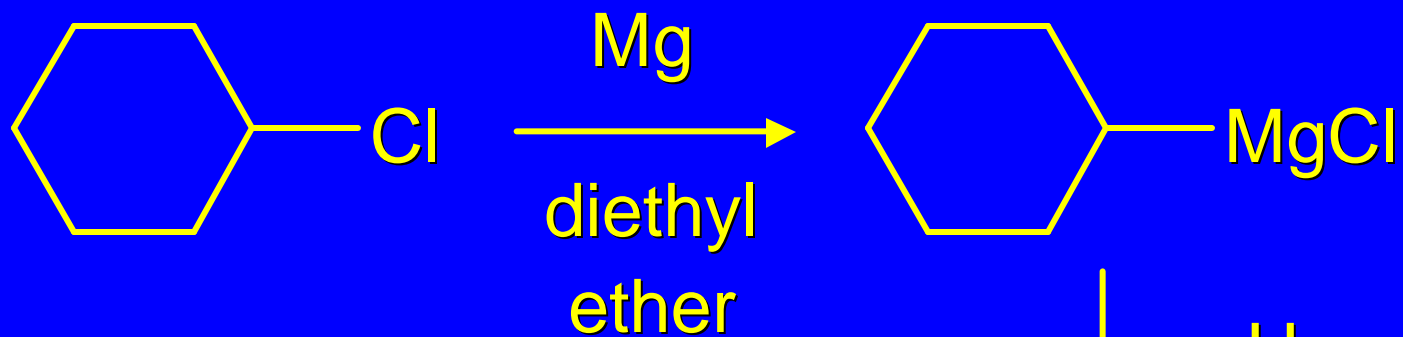
Grignard reagents react with:

formaldehyde to give primary alcohols

Grignard reagents react with formaldehyde



Example



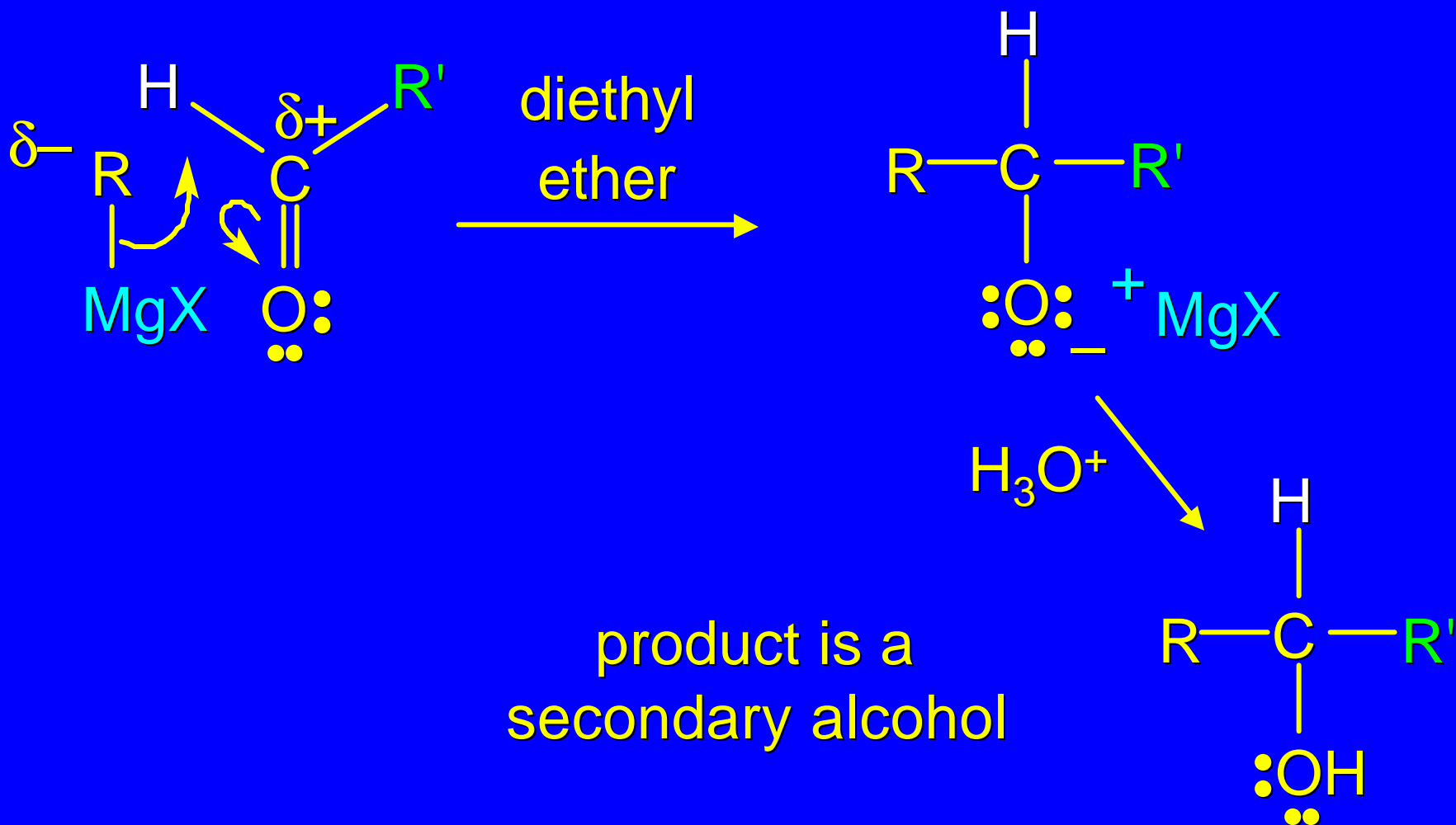
(64-69%)

Grignard reagents react with:

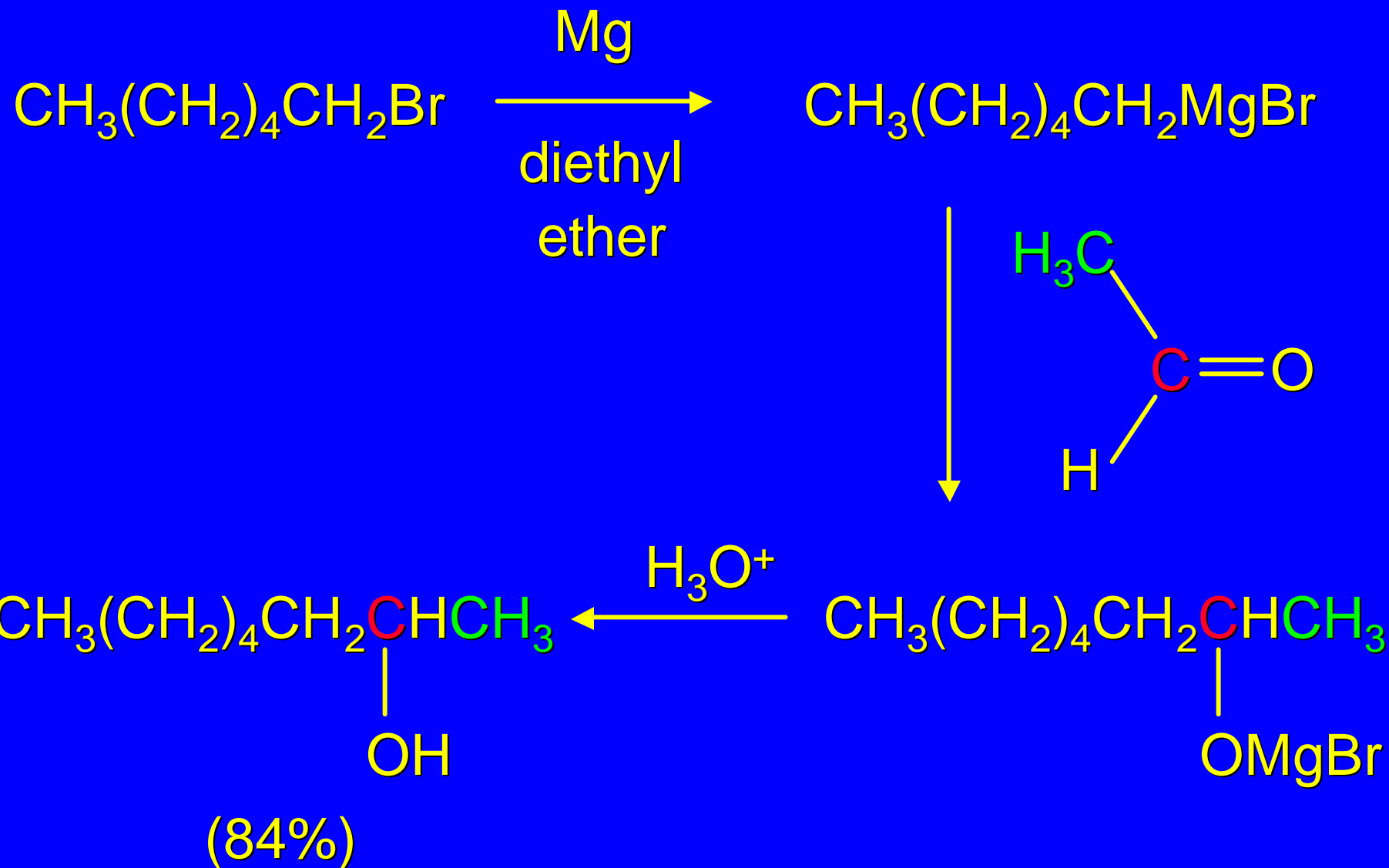
formaldehyde to give primary alcohols

aldehydes to give secondary alcohols

Grignard reagents react with aldehydes



Example



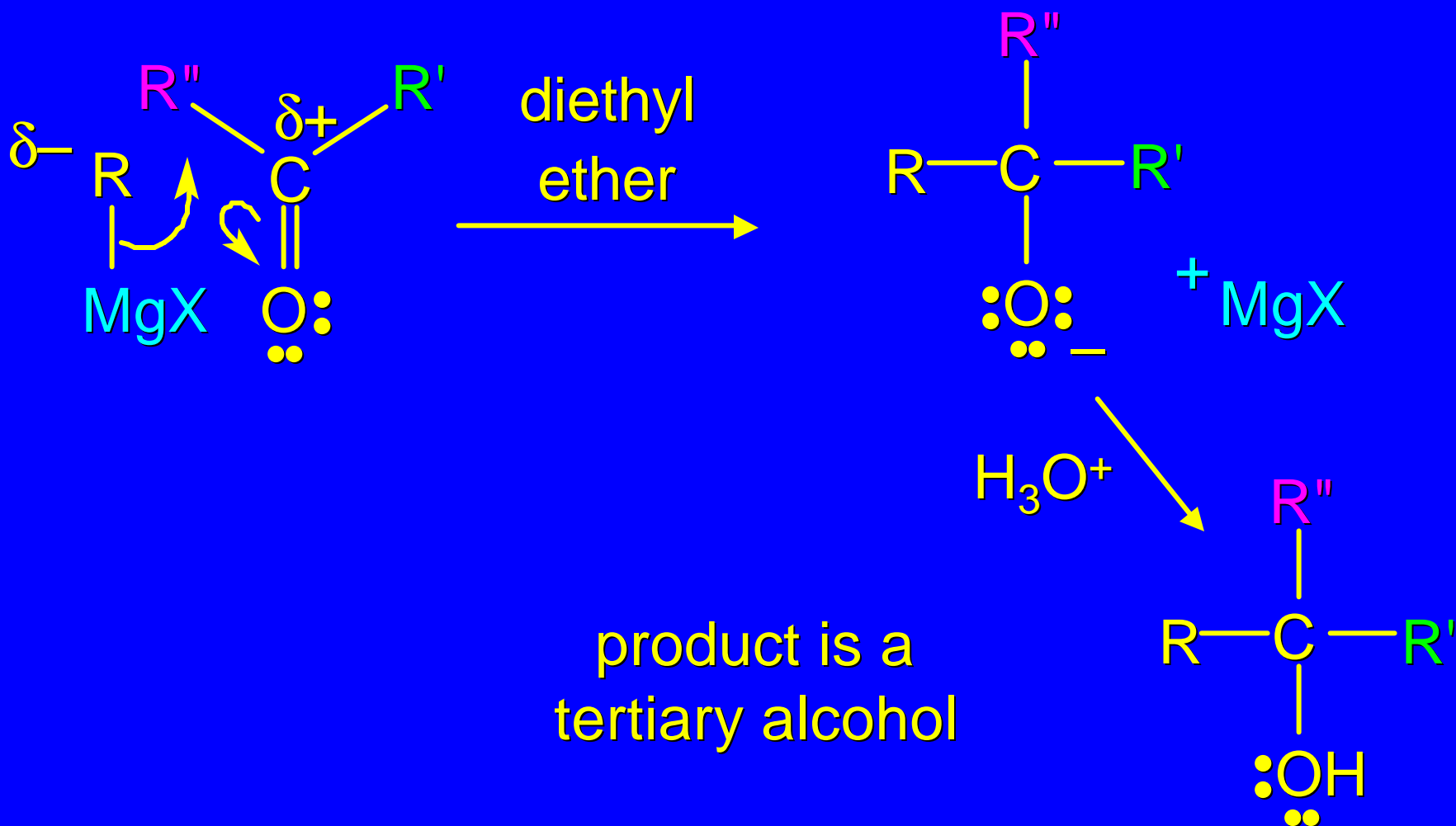
Grignard reagents react with:

formaldehyde to give primary alcohols

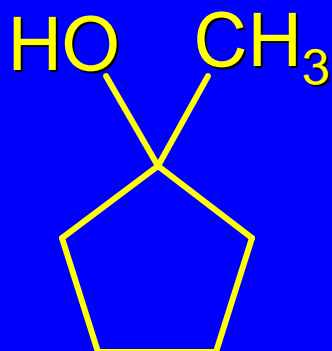
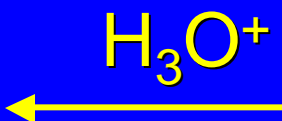
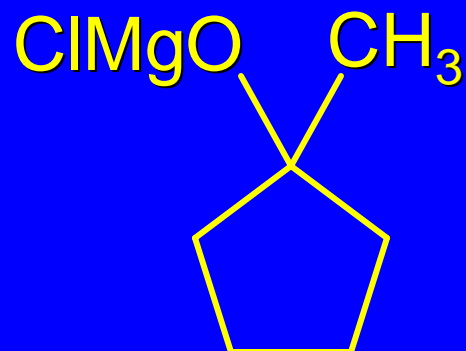
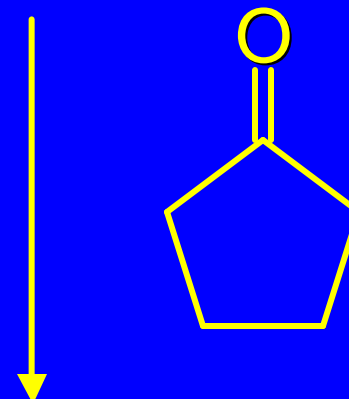
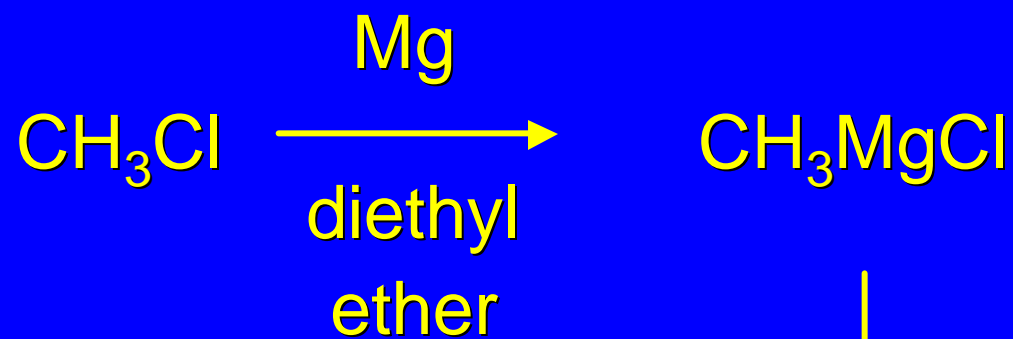
aldehydes to give secondary alcohols

ketones to give tertiary alcohols

Grignard reagents react with ketones



Example



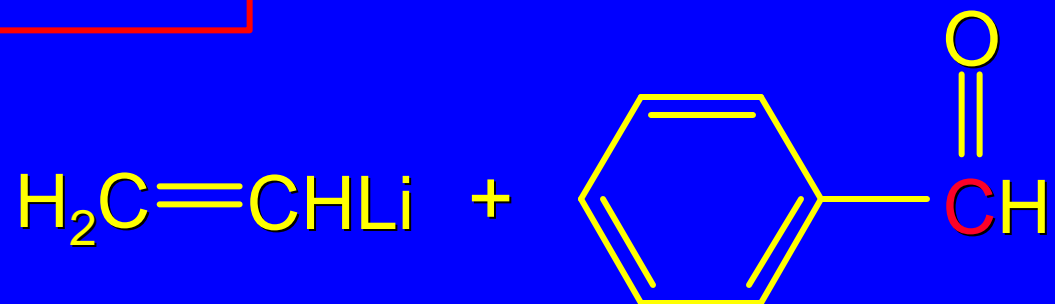
(62%)

14.7

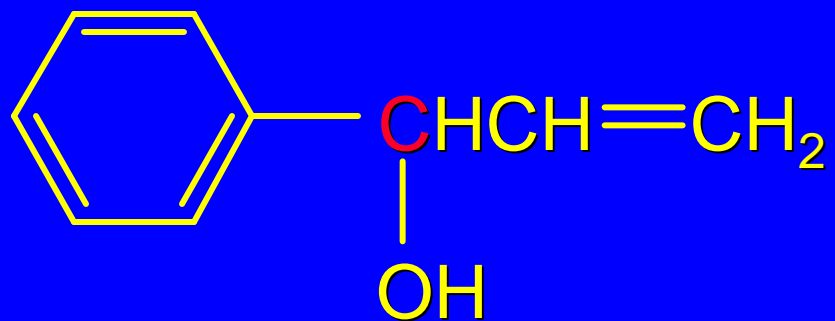
Synthesis of Alcohols Using Organolithium Reagents

Organolithium reagents react with aldehydes and ketones in the same way that Grignard reagents do.

Example



1. diethyl ether
2. H_3O^+

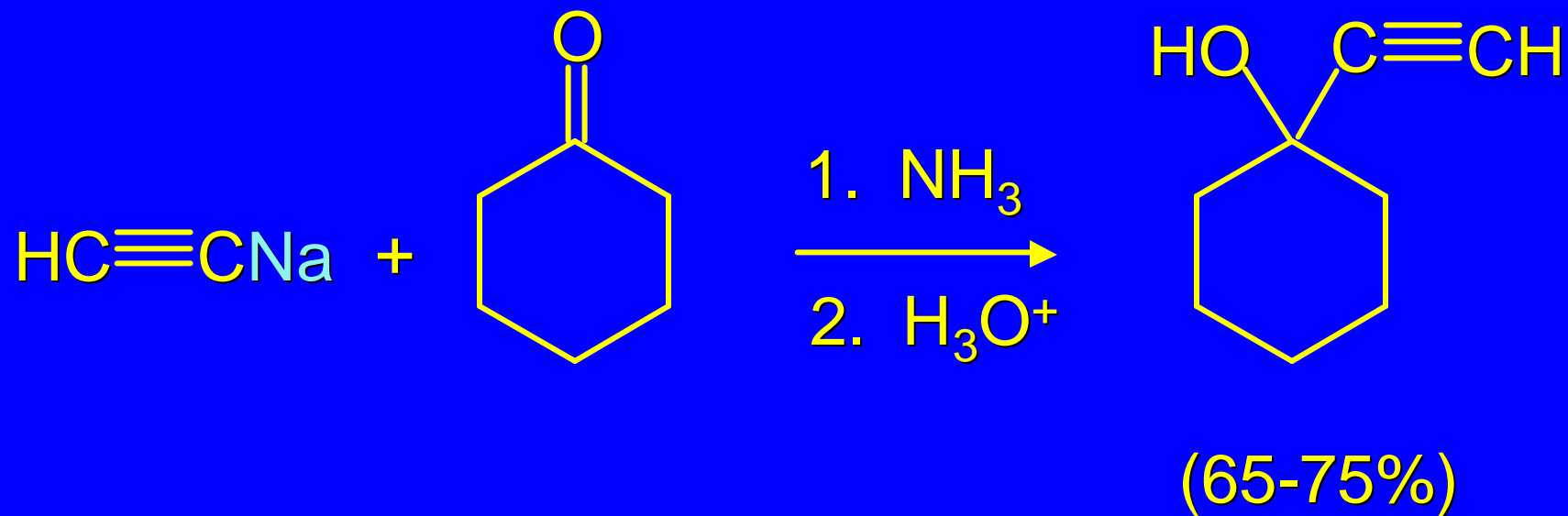
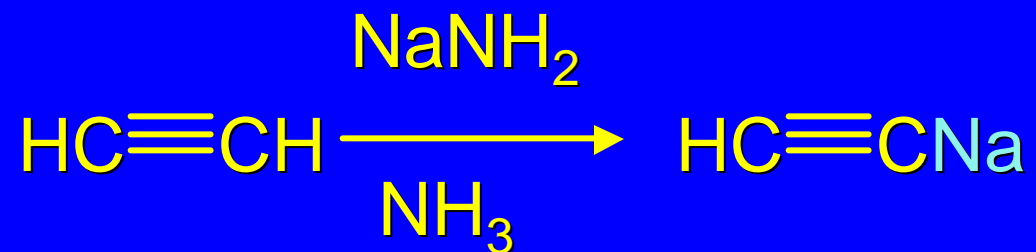


(76%)

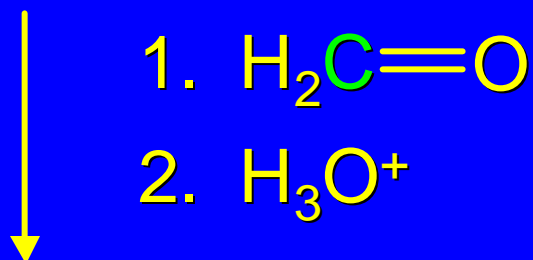
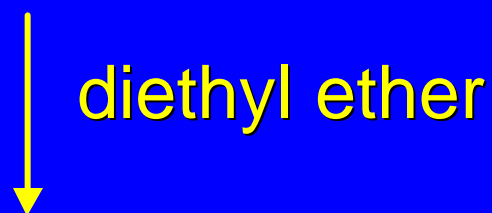
14.8

Synthesis of Acetylenic Alcohols

Using Sodium Salts of Acetylenes



Using Acetylenic Grignard Reagents



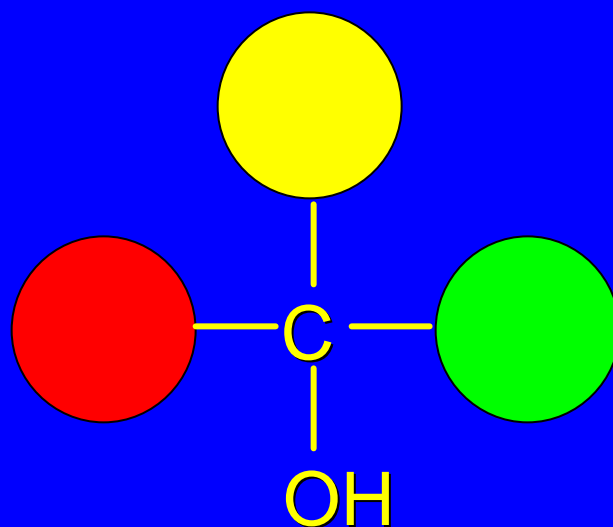
(82%)

14.9

Retrosynthetic Analysis

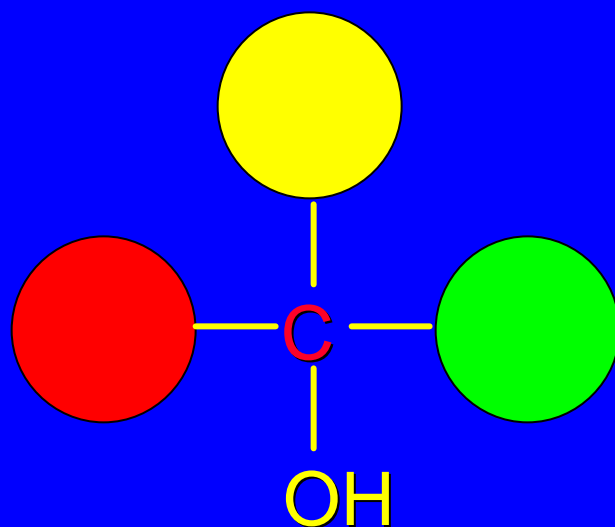
Retrosynthetic analysis is the process by which we plan a synthesis by reasoning backward from the desired product (the "target molecule").

Retrosynthetic Analysis of Alcohols



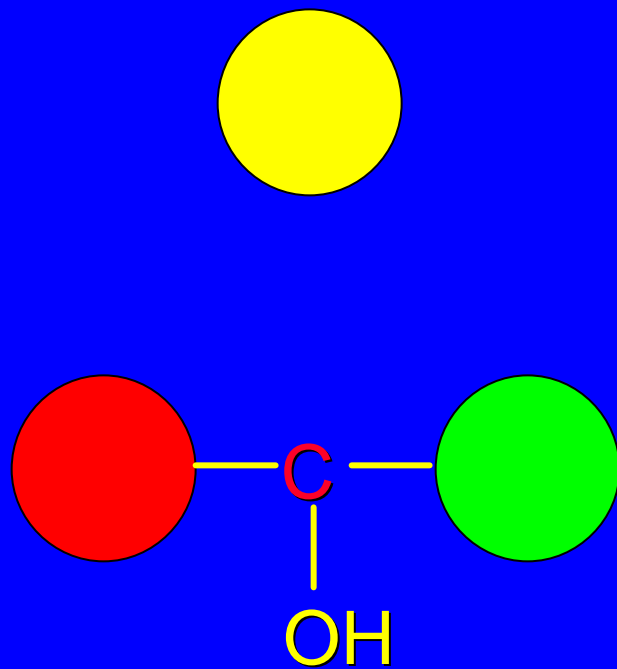
Step 1 Locate the carbon that bears the hydroxyl group.

Retrosynthetic Analysis of Alcohols

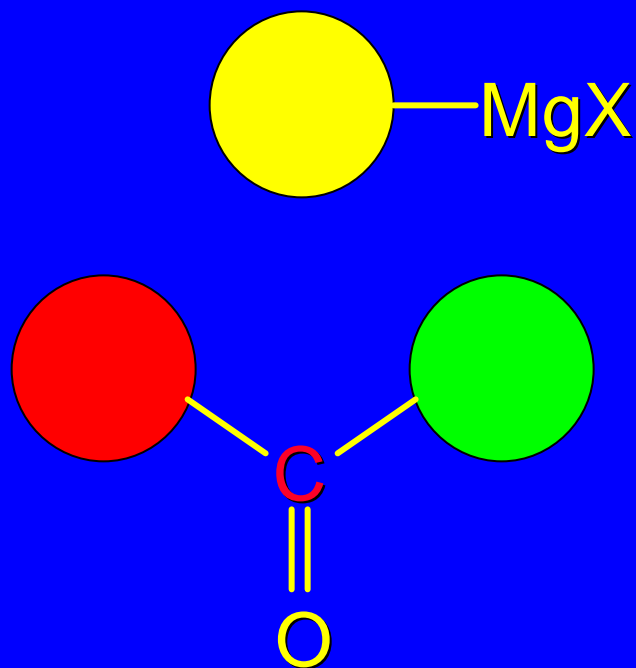


Step 2 Disconnect one of the groups attached to this carbon.

Retrosynthetic Analysis of Alcohols



Retrosynthetic Analysis of Alcohols

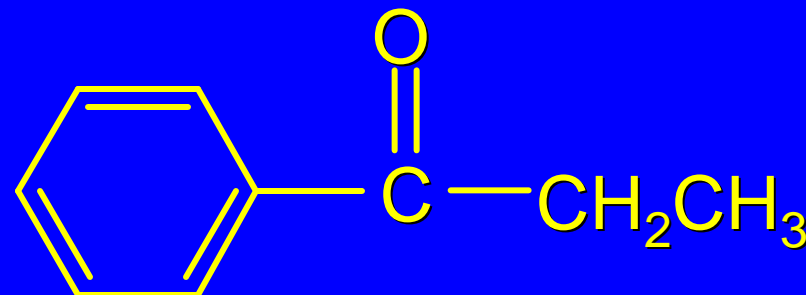
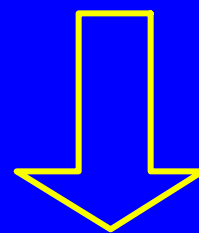
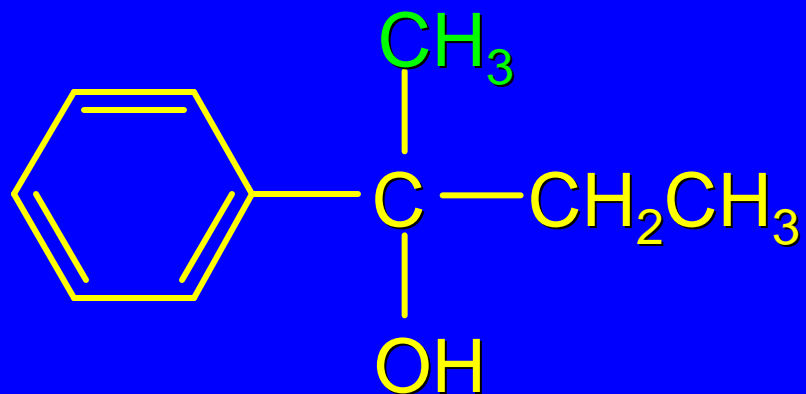


What remains is the combination of Grignard reagent and carbonyl compound that can be used to prepare the alcohol.

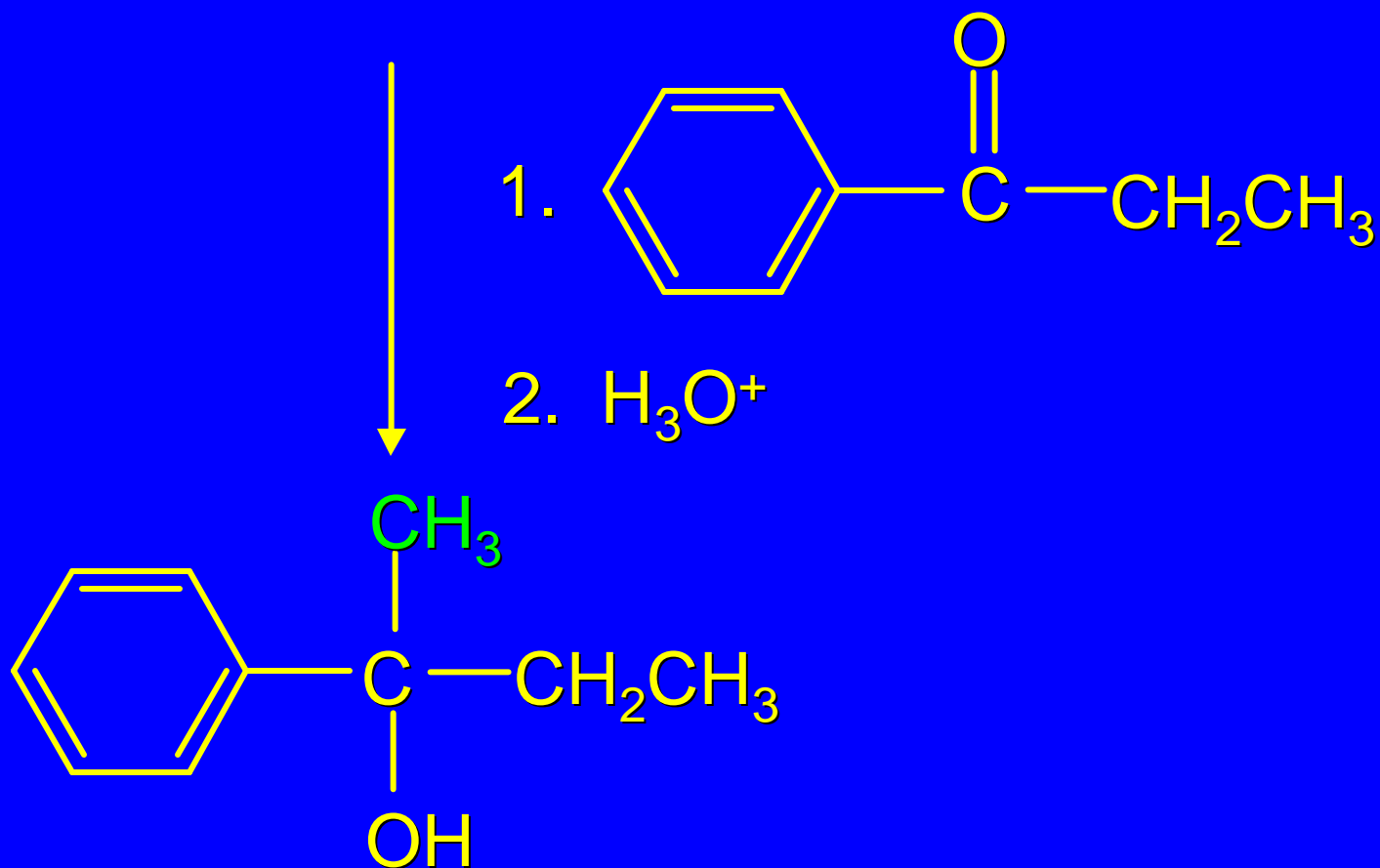
Example

There are two
other
possibilities.

Can you see
them?



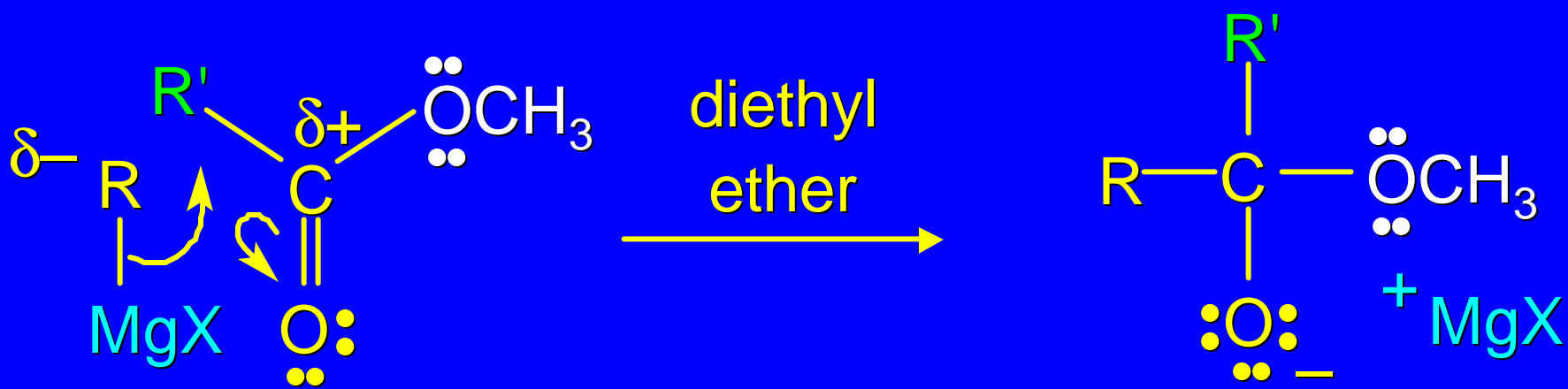
Synthesis



14.10

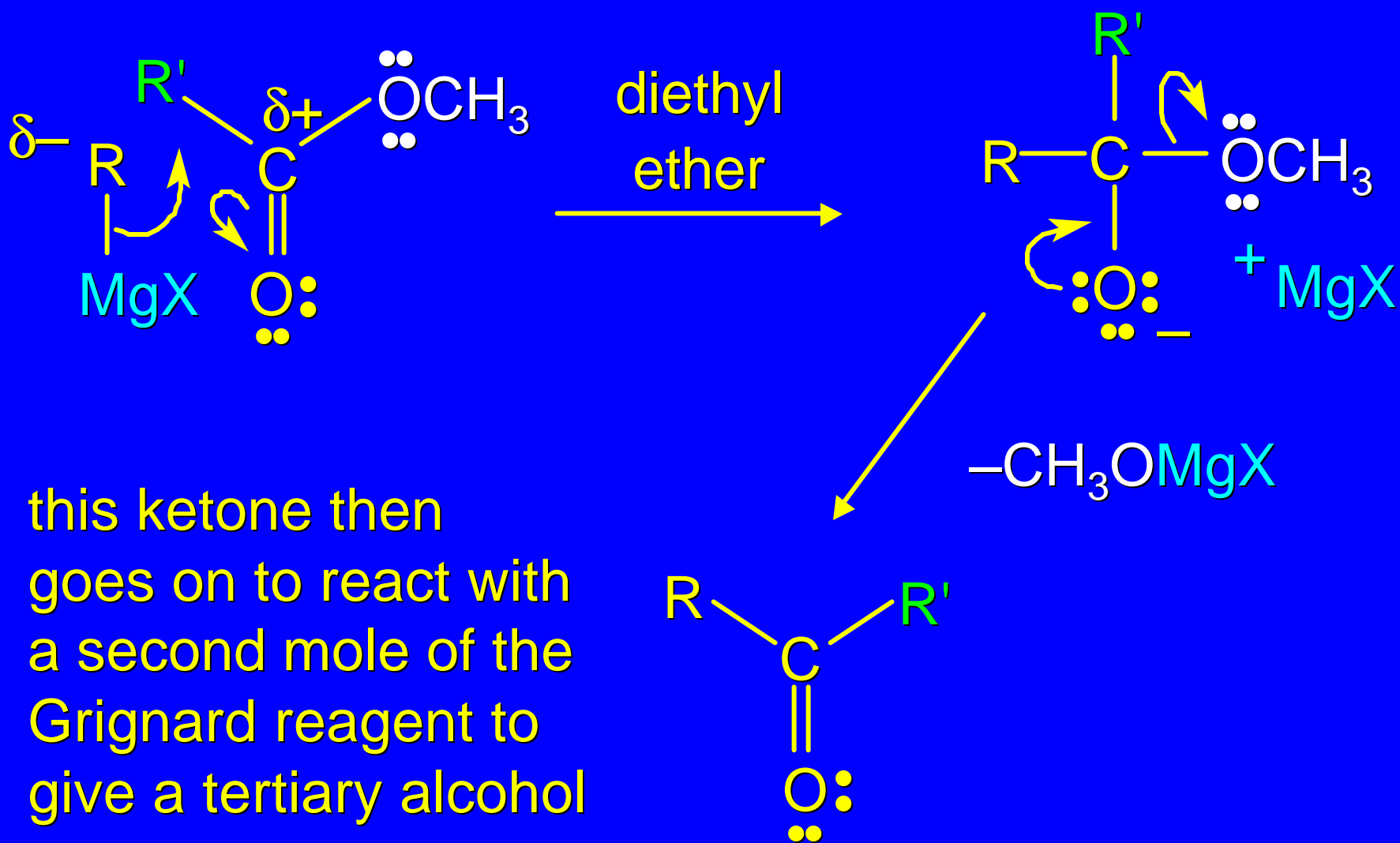
Preparation of Tertiary Alcohols
From Esters and Grignard Reagents

Grignard reagents react with esters



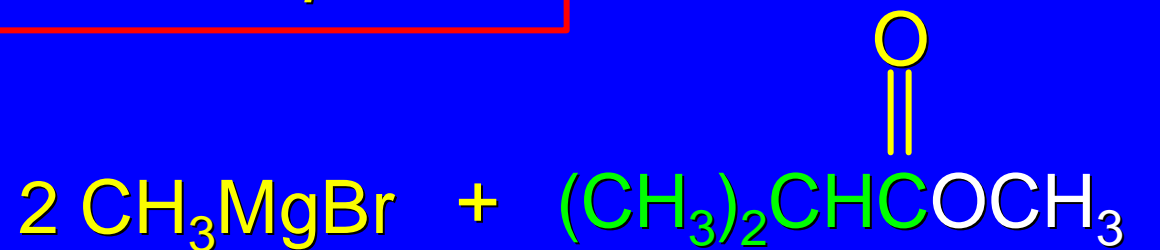
but species formed is
unstable and dissociates
under the reaction
conditions to form a ketone

Grignard reagents react with esters

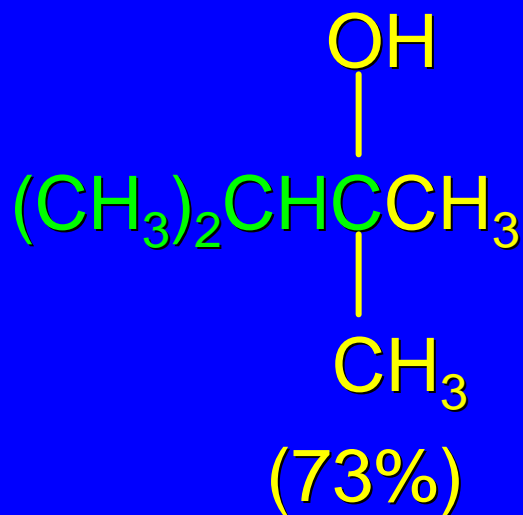


this ketone then goes on to react with a second mole of the Grignard reagent to give a tertiary alcohol

Example



1. diethyl ether
2. H_3O^+



Two of the groups attached to the tertiary carbon come from the Grignard reagent