# Learning Guide for Chapter 15 - Alcohols (II)

- I. Introduction to alcohol reactivity
- II. Reactions of alcohols with acids
- III. Reactions of alcohols with electrophiles Halogenated phosphorus and sulfur compounds Tosyl chloride
- IV. Reactions of alkoxides
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### I. Introduction to alcohol reactivity

In which of the following ways can an alcohol react?

As a base: yes no

.OH

As a nucleophile: yes no



As an acid: yes no



As an electrophile: yes no

OH

Can they be oxidized? yes no



Can they be reduced? yes no

**II.** Reactions of Alcohols with Acids

What is the first intermediate formed when an alcohol reacts with an acid?

What happens when a protonated alcohol dissociates?



Which of the following alcohols can form a protonated alcohol that can dissociate? What happens to the ones that can't?



What are the three things that can happen to a carbocation?



What else do we need to know to determine if the carbocation will react as an electrophile or acid?

What will happen when  $H_2SO_4$  or  $H_3PO_4$  is used as the acid?

Could this reaction give constitutional isomers and/or stereoisomers?

Why is the acid catalytic?

Why is heat usually required in this reaction?

Could this reaction go backward?

The equilibrium constant is near 1.0 - how can we get a good yield?

What will happen if HBr or HCl is used as the acid?

In order to make this reaction work well with HCl, what else needs to be added?

How could you use the Lucas test to determine whether the following alcohols were 1°, 2°, or 3°?

Predict the products of the following reactions.



#### **III. Reactions of Alcohols with Electrophiles**

What electrophile have we previously encountered that can react with an alcohol?

#### Halogenated phosphorus and sulfur compounds

What are the two most common phosphorus and sulfur reagents used as electrophiles with alcohols?

What type of compound results when they react with alcohols?



ОН —

What advantages do these reactions have when isolating the product?

What is the mechanism of the PBr<sub>3</sub> reaction?

What type of alcohols work best in these reactions? Why?

What products will the following reactions give?



If you want to convert an alcohol to an alkyl halide, which is the best way to do it?

R-Cl R-Br R-I 1° ROH 2° ROH 3° ROH

Convert the following alcohols to the products shown.



## Tosyl chloride

What product results when an alcohol reacts with tosyl chloride in pyridine?



How does this reaction occur?



How do tosylates react?



Give the products of the following reactions:







## IV. Formation and reactions of alkoxides

What reagents would be appropriate to form an alkoxide from the following alcohols?



Give the products of the following reactions:



From what alkoxide and tosylate could each of the following ethers be formed?





## V. Oxidation of Alcohols and Diols

What type of reaction is represented by all of the tranformations below? Give a reagent that would be effective for each.



What products can the following compounds be oxidized to?



Which reagents are commonly used for the following transformations?







Give the products of the following reactions:



What would you observe when doing a Jones test on the following alcohols?



What reagent is needed to cleave vicinal diols?

What products will result from the following reactions?



What reaction of alkenes gives the same result?

