Definition:

Types:

1. Primary:

2. Secondary:

3. Tertiary:

4. Phenols:

Nomenclature:

a) Locate the longest, continuous chain containing the hydroxyl group
b) Name as an alkane, dropping the “e” and adding “ol”.
c) Number the chain nearest to the hydroxyl group, and indicating the location of the hydroxyl group.

Examples:
Physical Properties:

a) Boiling Point:

b) Solubility in Water:
c) Acidity:

\[
\text{ROH} + \text{H}_2\text{O} \rightleftharpoons \text{RO}^- + \text{H}_3\text{O}^+ \\
\text{Ka}
\]

Mechanism:

pK\(_a\) examples:

16

18

15

13

10

18
Synthesis:

1. By Nucleophilic Substitution of Alkyl halides: Covered in Chp. 6 (Usually $S_{N2}$).
2. By Acid-Catalyzed Hydration of Alkenes: Covered in Chp. 8.

…Organometallic Chemistry:

6. By Grignard Addition:

1901: By Victor Grignard

Grignard (Addition) Reaction: $\text{RMgX} + \text{Electrophile} \rightarrow \text{Alcohol}$

$\text{RMgX} = \text{Grignard Reagent: A Great Nucleophile}$

Generation of Grignard Reagent:
Grignard Addition Mechanisms:

a) With Formaldehyde:
b) With Aldehydes:

c) With Ketones:

d) With Acid Chlorides:
e) With Esters:

f) With Ethylene Oxide:

7. By Addition of Organolithium Reagents to Formaldehyde, Aldehydes, and Ketones:

*General Reaction:*\[ \text{RLi} + \text{Electrophile} \rightarrow \text{Alcohol} \]

*RLi = Organolithium Reagent: A Great Nucleophile*

*Generation of Grignard Reagent:*\[ \text{R–X} + 2\text{Li} \rightarrow \text{RLi} + \text{LiX} \]

Example:
8. By Reduction of Carbonyl Group:

**General Scheme of Reaction:**

![Chemical structure of reduction reaction](image)

**Sources of Hydride (H⁻):**

1. NaBH₄: For Aldehydes and Ketones.

2. LiAlH₄: For Aldehydes, Ketones, Esters, and Carboxylate ions (under basic conditions):
Sources of hydronium ion ($H^+$):

1. Alcohols:

2. Water:

3. Aqueous Acidic Solutions:

Mechanism for Reduction:

9. Raney Nickel Hydrogenation of Aldehydes and Ketones:

***What is Raney Nickel?

***Raney-Ni hydrogenates both C=O and C=C!!! (Contrary to NaBH$_4$ and LiAlH$_4$)

Example: