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**Mat. No.: 19/MHS11/100**

**Dept.: PHARMACY**

**Course: CHM 102**

### Assignment

1. Discuss the two major classification of Alkanols. Give two examples each for each class.

### Answer

Alkanols are classified based on two categories;

- A. Based on their hydroxyl (OH) group.  
B. Based on the carbon holding their hydroxyl (OH) group.

#### A. Classification based on their hydroxyl (OH) group:

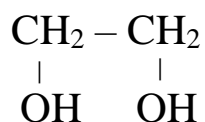
- i. **Monohydric Alkanol:** An alkanol with one hydroxyl (OH) group.

e.g Ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ )

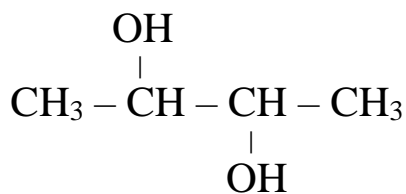
Methanol ( $\text{CH}_3\text{OH}$ )

- ii. **Dihydric Alkanol:** An alkanol with two hydroxyl (OH) group.

e.g;



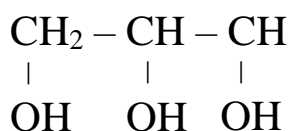
Ethane-1,2-diol



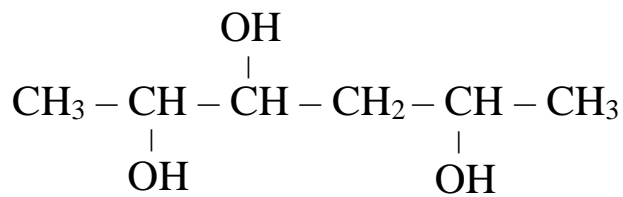
2,3-butanediol

- iii. **Trihydric Alkanol:** An alkanol with three hydroxyl (OH) group.

e.g;



Propan-1, 2, 3-triol

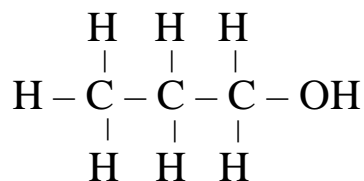


Hexane 2, 3, 5-triol

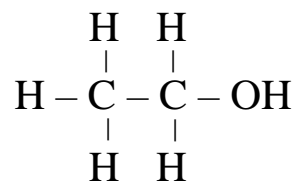
## B. Classification based on the carbon holding the OH group:

- i. **Primary Alkanol:** An Alkanol with one alkyl group attached to the carbon bearing the OH.

e.g;



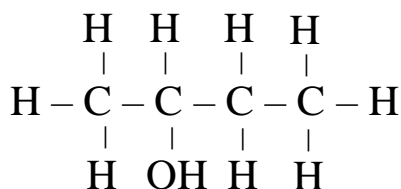
Propanol



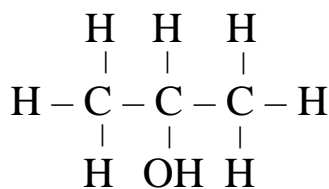
Ethanol

- ii. **Secondary Alkanol:** An Alkanol with two alkyl group attached to the carbon bearing the OH.

e.g;



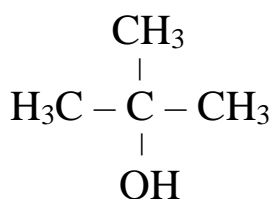
Butan-2-ol



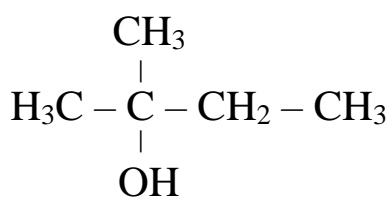
Propan-2-ol

- iii. **Tertiary Alkanol:** An Alkanol with three alkyl group attached to the carbon bearing the OH.

e.g;



tert – butylalcohol

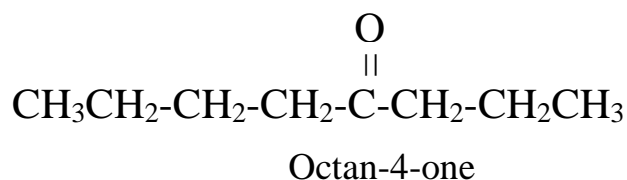


2-methyl-butan-2-ol

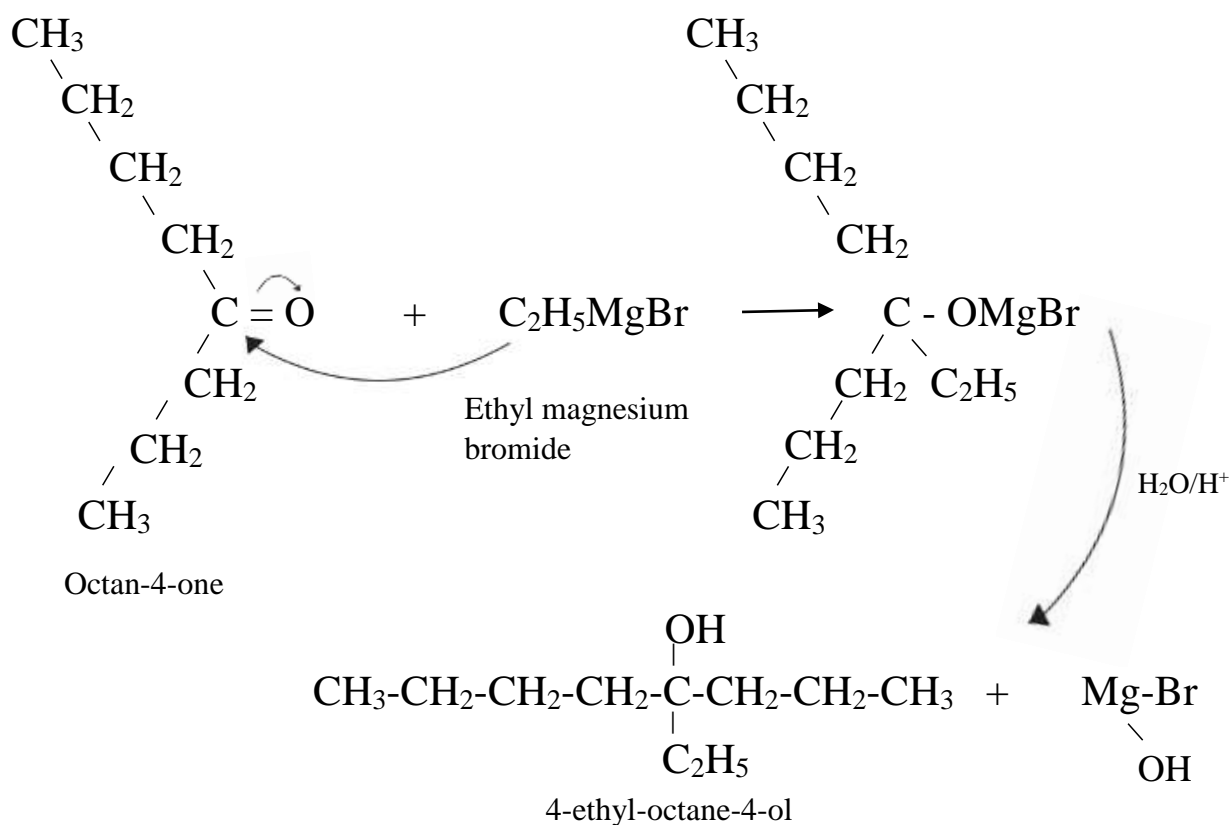
2. In the Grignard synthesis of Alkanols react a named Grignard reagent with  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{C}=\text{OCH}_2\text{CH}_2\text{CH}_3$ . Show the reaction steps.

**Answer**

Grignard reagent is an organometallic compound ( $\text{R-MgX}$ ) that is used in the synthesis of wide arrays of organic compounds including alkanols.



The compound above (Octan-4-one) is a ketone. It will react with a Grignard reagent e.g ethyl magnesium bromide ( $\text{C}_2\text{H}_5\text{MgBr}$ ) to give a tertiary alkanol.



3. Discuss the industrial manufacture of ethanol showing all reaction equations and necessary enzymes and temperature of reaction.

### **Answer**

Ethanol is manufactured industrially by the fermentation of starch in the presence of suitable microorganism which produces the enzymes that act as a catalyst.

Starch is a polysaccharide carbohydrate and is an important source of ethanol. Usually, potato, rice, maize or barley are used as source of starch. Potato is mostly used.

### **Extraction of Starch**

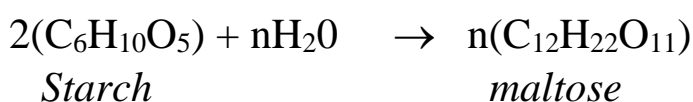
The crushed potato is steamed at 140<sup>0</sup> to 150<sup>0</sup> under pressure to prepare starch solution known as MASH.

### **Germination**

Before hydrolysis, starch first undergo germination at 10<sup>0</sup>C to 13<sup>0</sup>C for few days. This germinated starch is called MALT.

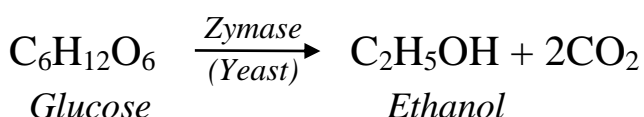
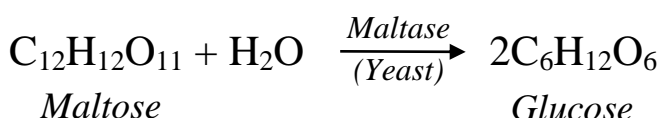
### **Hydrolysis of Starch**

Starch is hydrolyzed to maltose by an enzyme known as diastase



### **Fermentation**

Finally, yeast is added to maltose. Yeast secrete two enzymes; maltase (converts maltose to glucose) and zymase (convert glucose to ethanol).



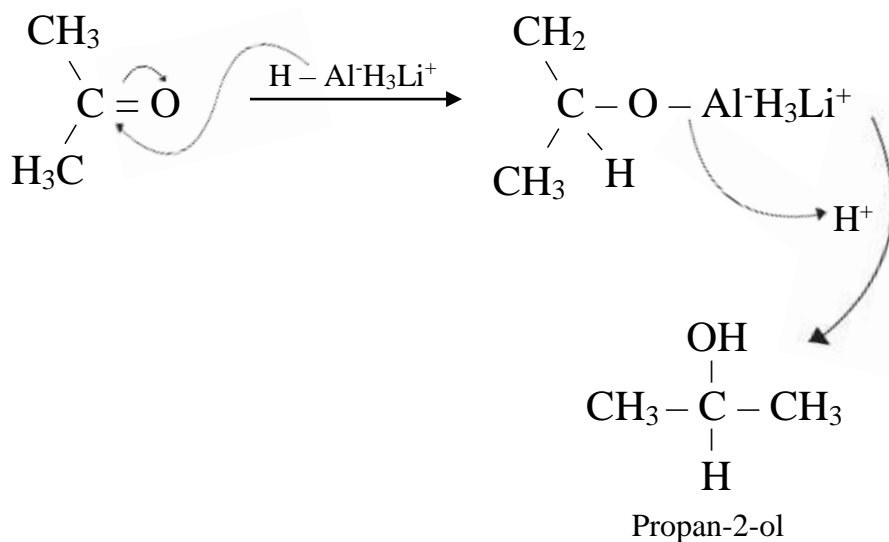
4. Determine the product obtained in the reduction of Alkanone and Alkanal.  
Use a specific example for each and show the equation of reaction.

### Answer

Reduction of alkanone or ketone gives a secondary alkanol while reduction of an alkanal or aldehyde gives a primary alkanol.

Reduction of alkanone e.g acetone

The reducing agent used is Lithium aluminum hydride ( $\text{LiAlH}_4$ ) or Sodiumborohydride ( $\text{NaBH}_4$ ).



Reduction of alkanal e.g ethanol

