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**DEPARTMENT: MECHATRONICS ENGINEERING.**
**COURSE: CHM 102**

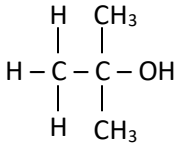
**COVID-19 HOLIDAY ASSIGNMENT**

**QUESTION 1**

Alcohols are very important organic compounds. Discuss briefly their classification and give one example each.

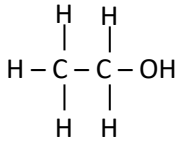
SOLUTION

A. Classification based on the number of hydrogen atoms attached to the carbon atom that is bearing the hydroxyl group.
If the number of hydrogen atoms attached to the carbon bearing the hydroxyl group is three or two, the alkanol is called a primary alkanol($1^0$). If the number of hydrogen atoms attached is one, the alkanol is called a secondary alkanol($2^0$). And if the number of hydrogen atoms attached is zero, the alkanol is called a tertiary alkanol($3^0$)
EXAMPLES:

I. 

2-methylpropan-2-ol
(Tertiary Alkanol)

B. Classification based on the number of hydroxyl groups the alkanol posseses.
If there is one hydroxyl group in a molecule of the alkanol, it is called a monohydric alkanol. If there are two hydroxyl groups in a molecule of the alkanol, it is called a dihydric alkanol. If the number of the hydroxyl group is three, it is called a trihydric alkanol.
EXAMPLES:

I. 

Ethanol
(Monohydric Alkanol)

**QUESTION 2**

Discuss the solubility of alcohols in water, organic solvents.

SOLUTION

SOLUBILITY:

Lower alcohols with up to three carbon atoms in their molecules are soluble in water because these lower alcohols can form hydrogen bond with water molecules. The water solubility of alcohols decreases with increasing relative molecular mass.

All monohydric alcohols are soluble in organic solvents. The solubility of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bond with water molecules.

**QUESTION 3**

Show the three steps in the industrial manufacture of ethanol. Equations of reaction are mandatory

SOLUTION

FERMENTATION OF STARCH

Crush starch containing materials like potatoes, molasses, cereals, rice etc. to break the plant cells so that the starch granules could easily be extracted using water.

Warm the suspension of starch granules with malt to $60^0$C for a specific period of time say 1 hour.

The starch granules are converted to maltose by the enzyme diastase present in the malt.

$$\underset{\text{starch}}{2(C_6H_{10}O_5)n} + nH_2O \xrightarrow[\text{diastase}]{60^0C} \underset{\text{maltose}}{nC_{12}H_{22}O_{11}}$$

The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase at a temperature of $15^0$C.

$$\underset{\text{maltose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow[\text{maltase}]{15^0C} \underset{\text{glucose}}{2C_6H_{12}O_6}$$

The glucose at constant temperature of $150^0$C is then converted into ethanol by the enzyme zymase present in the yeast.

$$\underset{\text{glucose}}{C_6H_{12}O_6} \xrightarrow[\text{zymase}]{15^0C} \underset{\text{Ethanol}}{2C_2H_5OH} + 2CO_2$$

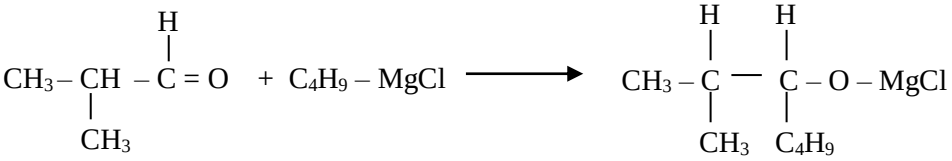
**QUESTION 4**

Show the reaction between 2-methylpropanal and butylmagnesiumchloride
Hint: Grignard synthesis

SOLUTION

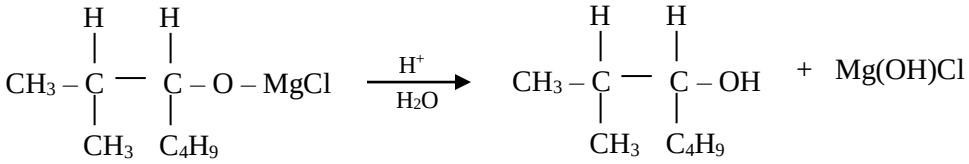
STEP 1

Mixing Grignard reagent (butylmagnesiumchloride) with 2-methylpropanal ($CH_3CH(CH_3)CHO$).



STEP 2

Recovery of the alkanol by adding acidic water to the completed reaction mixture.



2 – Methylheptan – 3 – ol

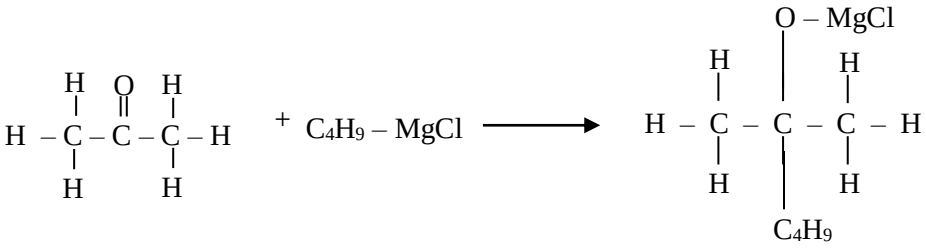
**QUESTION 5**

Show the reaction between 2-methyl propanone and butylmagnesiumchloride
Hint: Grignard synthesis. Note: show all structures

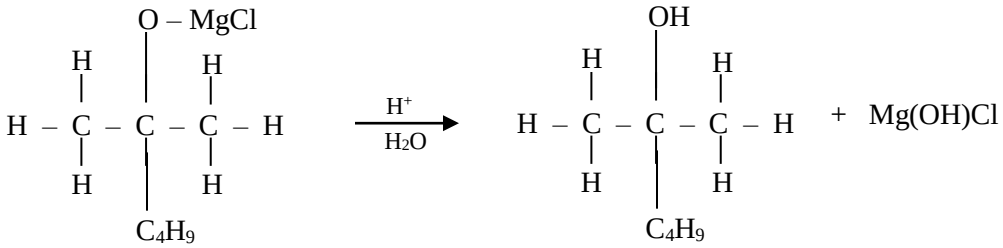
SOLUTION

**N.B: 2 – Methylpropanone doesn't exist. But I will be working with propanone**

STEP 1: Mixing Grignard reagent (butylmagnesiumchloride) with propanone($CH_3COCH_3$).



STEP 2: Recovery of the alkanol by adding acidic water to the completed reaction mixture.

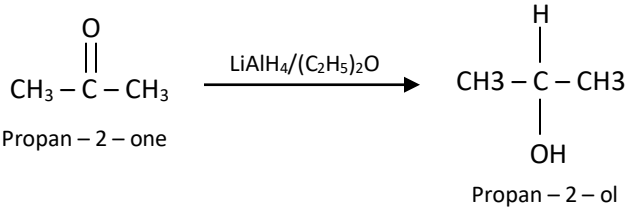


2 – Methylhexan – 2 – ol

**QUESTION 6**

Show the reduction reaction of 2-methylpropanone

SOLUTION



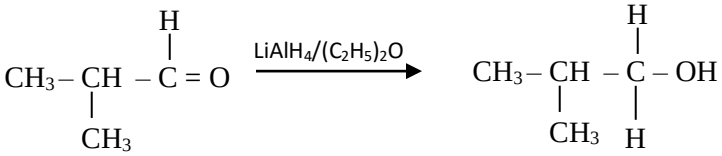

Propan – 2 – one

Propan – 2 – ol

**QUESTION 7**

Show the reduction reaction of 2-methylpropanal

SOLUTION




**QUESTION 8**

Propose a scheme for the conversion of propan-1-ol to propan-2-ol.

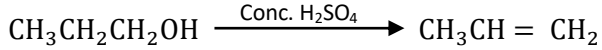
SOLUTION

STEP 1

DEHYDRATION OF PROPAN – 1 – OL TO PROPENE USING CONCENTRATED TETRAOXOSULPHATE (VI) ACID.

When propan – 1 – ol is treated with concentrated tetraoxosulphate (VI) acid (H2SO4), the phenomenon called dehydration occurs due to which a water molecule from propan – 1 – ol gets eliminated.

Due to this, propan – 1 – ol gets converted into propene. The reaction involved is as follows:



STEP 2

HYDROLYSIS OF PROPENE TO PROPAN – 2 – OL USING WATER.

Propene can be hydrolysed to propan – 2 – ol in accordance with mechanism called as Markownikoffs addition.
It states that when an unsymmetrical reagent, the negative part of the reagent gets attached itself to the carbon atom of the alkene wich has less number of hydrogen atom.
In this case, the unsymmetrical reagent used is water which is composed of $H^+$ and $OH^-$ parts.
Due to the hydrolysis of water, the negative part attaches itself to the propene and thus converts it as propan – 2 – ol.
The reaction involved is as follows:

$$CH_3CH = CH_2 \xrightarrow{H_2O} CH_3 - CH_2 - OH - CH_3$$