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MATRIC NUMBER: 19/MHS01/384
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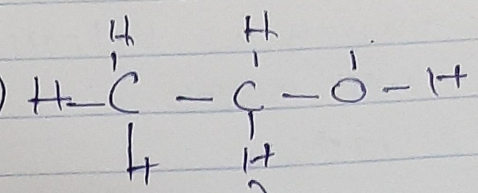
1. Alcohols are very important organic compounds Discuss briefly their classification and give one example each.

i) Classification based on their number of hydrogen atoms attached to the Carbon atom Containing the hydroxyl group.

If the number of hydrogen atoms attached to the Carbon atom bearing the hydroxyl groups are three or two, it is called A PRIMARY ALCOHOL (1°) [in a Primary alcohol, the hydroxyl group attached to ~~the~~ primary Carbon atom in the molecule, it is characterized by $-CH_2OH$]. If it is one hydrogen atom attached to a saturated Carbon atom bearing the hydroxyl group, it is called "Seconday alcohol" [2°] [in Secondary alcohol the -OH group is attached to a seconday Carbon atom. It is characterized by CHOH]. If no hydrogen atom is attached to the Carbon atom bearing the hydroxyl group, then it is called a tertiary alcohol (3°)

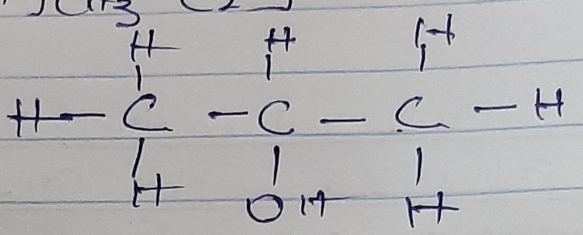
Examples:

CH_3CH_2OH (1°)



Ethanol (Primary alcohol)

$CH_3CH(OH)CH_3$ (2°)



Propan-2-ol [Secondary alcohol]

[b] Classification based on the number of hydroxyl group they Posses

Monohydric alcohols have one hydroxyl group Present in the alcohol structure. Dihydric alcohols are also called Glycols they have two hydroxyl groups present in the alcohol structure. Trihydric alcohols or triols have three hydroxyl groups present in the structure of the alcohol. Polyhydric alcohols have more than three hydroxyl groups

Examples

$CH_3CH_2CH_2OH$ Propanol (Monohydric alcohol)

$HOCH_2CH_2OH$ Ethane-1,2-diol (Dihydric alcohol)

$OHCH_2CH(OH)CH_2OH$ Propane-1,2,3-triol (Trihydric alcohol)

$CH_3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH_3$

Heptane-2,3,4,5,6-Pentanol (Poly hydric alcohol)

2. Discuss the solubility of alcohols in water, Organic solvent

lower alcohols with up to three Carbon atoms in their molecules is 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 bonds with water molecules.

3. Show the three steps in the Industrial manufacture of Ethanol. Equations of reactions are mandatory

(i) Carbohydrates such as starch are major groups of natural compounds that can be made to yield ethanol by the biological Process of fermentation. The biological catalyst enzymes found in the yeast of 95%, The starch containing materials include molasses, Potatoes, cereals, rice and warming with malt to 60°C for a specific Period of time are converted into maltose by the enzymes diastase contained in the malt.

$$2(C_6H_{10}O_5)_n + nH_2O \longrightarrow nC_{12}H_{22}O_{11}$$

Carbohydrate — 60°C/diatase — maltose

ii The maltose is broken down into glucose on addition of yeast which contain the enzyme maltase and at a temperature of 15°C

$$C_{12}H_{22}O_{11} + H_2O \longrightarrow 2C_6H_{12}O_6$$

maltose — 15°C/maltase — Glucose

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iii) The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme zymase contained also in yeast

$$C_6H_{12}O_6 \xrightarrow{15\,^\circ C\ /\ \text{zymase}} 2CH_3CH_2OH + 2CO_2$$

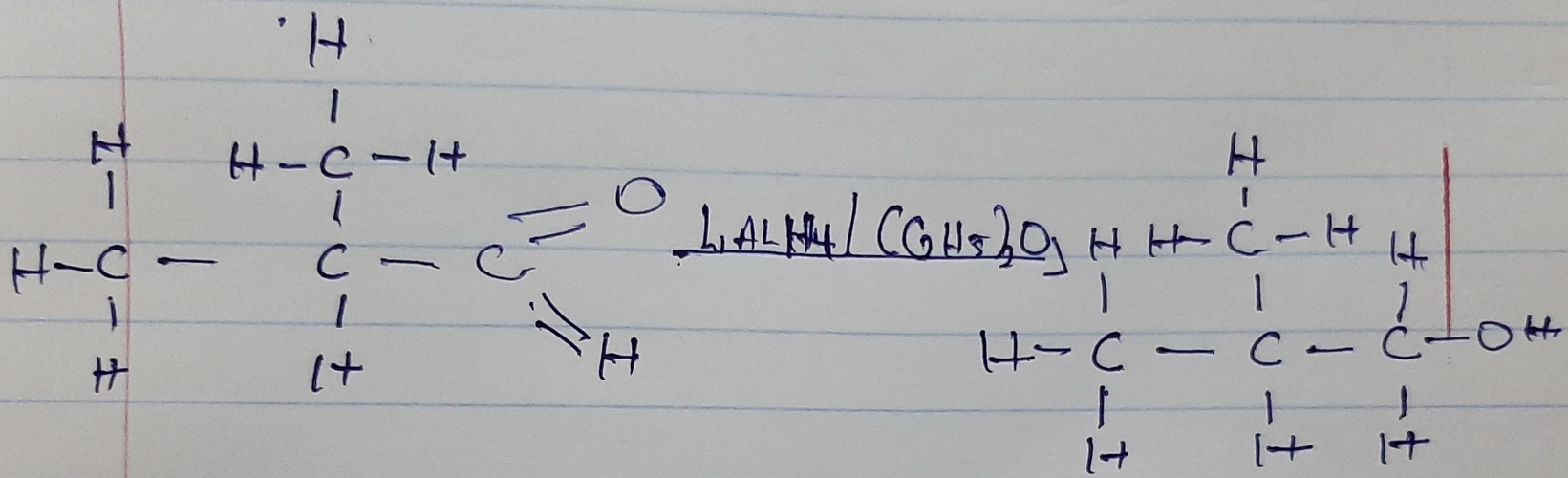
Glucose — ethanol

4 Show the reaction between 2-methy propanal and butymagnesiumchloride Hint: Grignard synthesis

$$C_4H_9MgCl + (CH_3)_2CHCHO \rightarrow (CH_3)_2CH-\underset{H}{\overset{C_4H_9}{\underset{|}{C}}}-OMgCl$$

$$(CH_3)_2CH-\underset{H}{\overset{C_4H_9}{\underset{|}{C}}}-OMgCl \xrightarrow[\text{dil acid}]{H^+\ OH^-} (CH_3)_2CH-\underset{H}{\overset{C_4H_9}{\underset{|}{C}}}-OH + Mg(OH)Cl$$

7 Show the reduction reaction of 2-methyl Propanal.

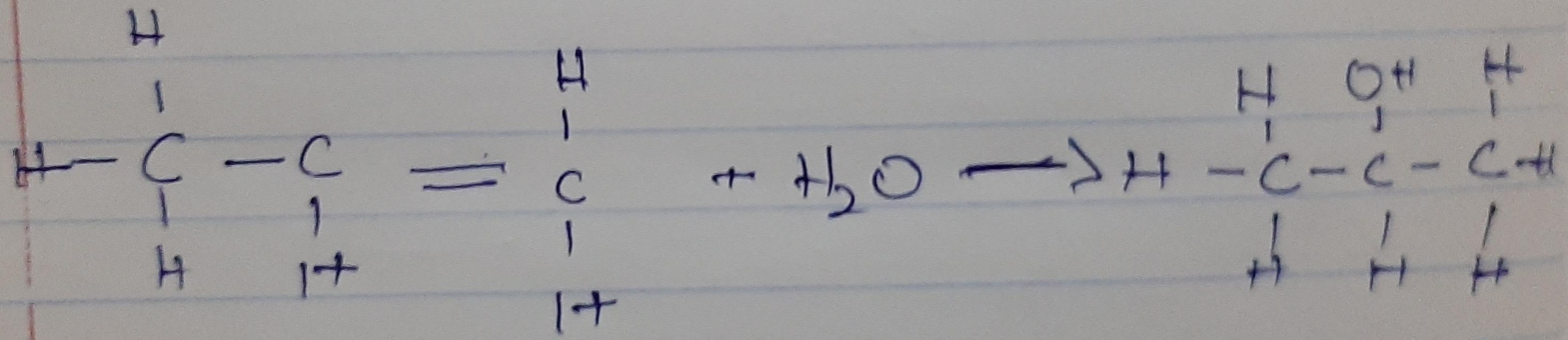


2-methyl propanal

2-methypropan-1-ol

d) Propose a Scheme for the Conversion of propan-1-ol to Propan-2-ol

- Heat propan-1-ol in the Presence of Sulphuric acid to dehydrate it to propene Then add water to form Propan-2-ol



Propan-2-ol