

4TH MAY, 2020.

AKPOFURE TESE

19/MHS01/077

100 LEVEL

MEDICINE AND SURGERY

MEDICINE AND HEALTH SCIENCES

CHM 102 - GENERAL CHEMISTRY II

ASSIGNMENT

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

Classification 1

It is based on the number of hydrogen atoms attached to the carbon atom carrying the OH (hydroxyl) functional group. If the number of hydrogen atoms attached to the carbon atom carrying the OH group are three (3) or two (2), then it is a primary alcohol (1°). If it is just one hydrogen atom, then it is a secondary alcohol (2°). If there are no hydrogen atoms attached to the carbon atom containing the OH group at all, then it is a tertiary alcohol (3°). Examples are:

- Primary alcohols: CH_3OH (Methanol), $\text{CH}_3\text{CH}_2\text{OH}$ (Ethanol)
- Secondary alcohols: $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ (Propan-2-ol)
- Tertiary alcohols: $(\text{CH}_3)_3\text{C-OH}$ (2-methylpropan-2-ol)

Classification 2

This classification is based on the number of hydroxyl (OH) functional groups in the structure of the alcohol. When there is just one hydroxyl (OH) functional group present in the alcohol structure, it will be called a monohydric alcohol. When there are two hydroxyl functional groups, it is called a dihydric alcohol or glycol. If there are three hydroxyl functional groups, it will be a

trihydric alcohol or triol. If there are more than three hydroxyl functional groups, it is a polyhydric alcohol or polyol.

Examples are:

- Monohydric alcohols: $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (Propanol)
- Dihydric alcohols: $\text{HOCH}_2\text{CH}_2\text{OH}$ (Ethane-1,2-diol), $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$
- Trihydric alcohols: Propan-1,2,3-triol
- Polyhydric alcohols: Heptan-2,3,4,5,6-pentanol.

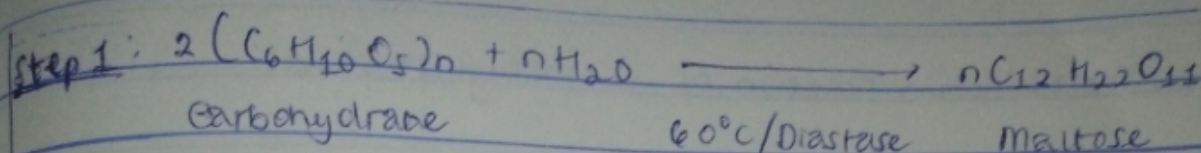
2. Discuss the solubility of alcohols in water, organic solvents.

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.

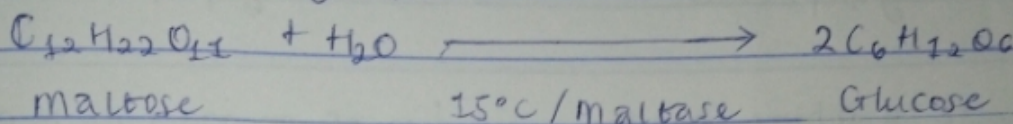
All monohydric alcohols are soluble in organic solvents. The solubility of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bonds with water molecules.

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

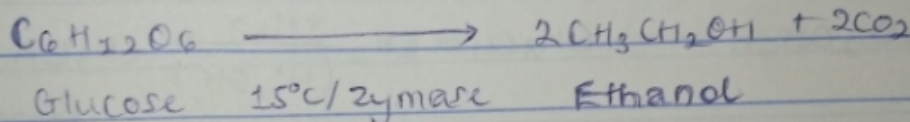
Ethanol is derived from the biological process of fermentation of carbohydrates. Carbohydrates such as starch is a major group of natural compounds that can yield ethanol by fermentation. The biological catalysts, enzymes found in yeast break down the carbohydrate molecules into ethanol to give a yield of 95%. The starch containing materials include molasses, potatoes, cereals, rice and when warmed with malt to 60°C for a specific period of time are converted into maltose by the enzyme, diastase contained in the malt. This describes the first step.



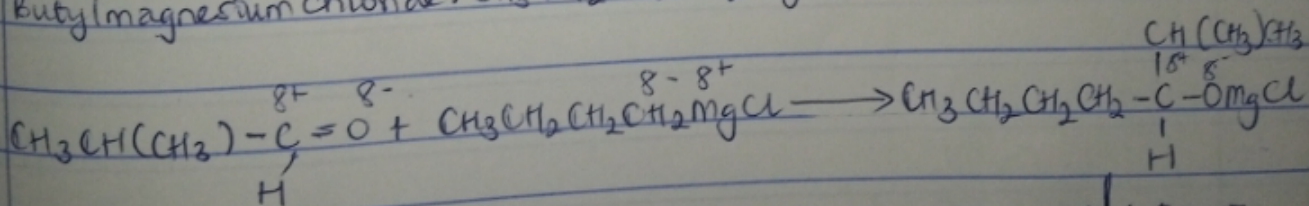
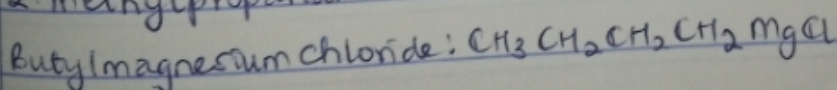
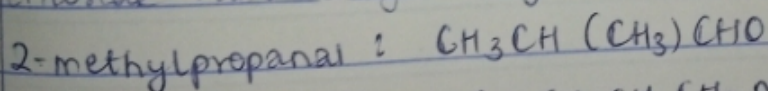
Step 2: The maltose is broken down into glucose on addition of yeast which contains the enzyme, maltase and a temperature of $15^\circ C$.



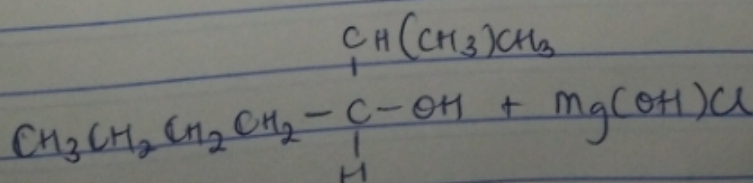
Step 3: The glucose at constant temperature of $15^\circ C$ is then converted into alcohol by the enzyme, zymase, also contained in yeast:



4. Show the reaction between 2-methylpropanal and butylmagnesium chloride. Note: Grignard synthesis.

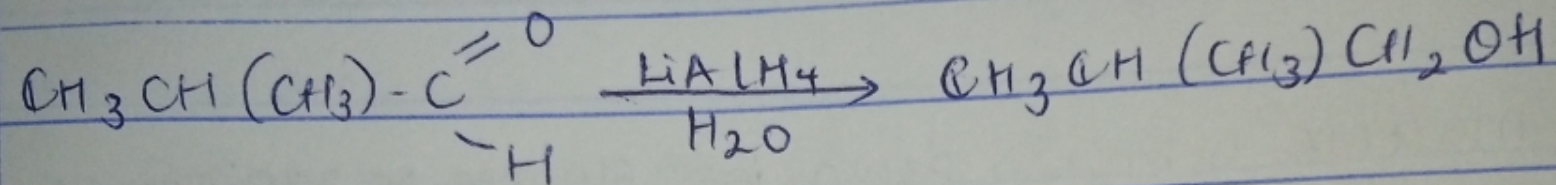


Dil. acid $H^+ OH^-$



2-methyl heptan-3-ol
 (Secondary alcohol)

7. Show the reduction reaction of 2-methyl propanal.



2-methylpropanal

2-methylpropanol

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

