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a. CLASSIFICATION BASED ON NUMBER OF HYDROGEN ATOMS ATTACHED TO CARBON ATOMS: If the numbers of hydrogen attached to the carbon atom bearing the hydroxyl group are two or three, it is called a primary alcohol( $1^\circ$ ), . If it is one hydrogen atom, it is called secondary alcohol( $2^\circ$ ). and if no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it is called a tertiary alcohol( $3^\circ$ ).

Examples:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$  (Butanol( $1^\circ$ ))

b. CLASSIFICATION BASED ON THE NUMBER OF HYDROXYL GROUPS THEY POSSESS: Monohydric alcohols have one hydroxyl group present in the alcohol structure. Dihydric alcohols have two hydroxyl groups present in the alcohol structure while trihydric alcohols have three hydroxyl groups present in the structure of the alcohol. Polyhydric alcohols have more than three hydroxyl groups.

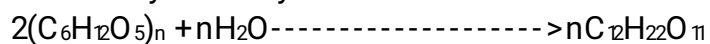
Examples:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  Propanol (Monohydric alcohol)

## 2. Solubility of alcohol

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

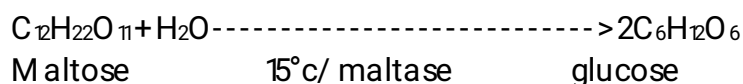
## 3. Three steps in the industrial manufacture of ethanol with equation

A. Conversion of starch: Starch containing material including rice, Yam etc on warming with malt to  $60^\circ\text{C}$  for a specific period of time are converted into maltose by the enzyme diastase contained in malt.

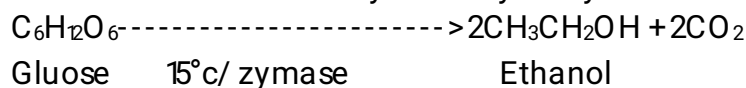


Carbohydrate       $60^\circ\text{C}/$  diastase      maltose

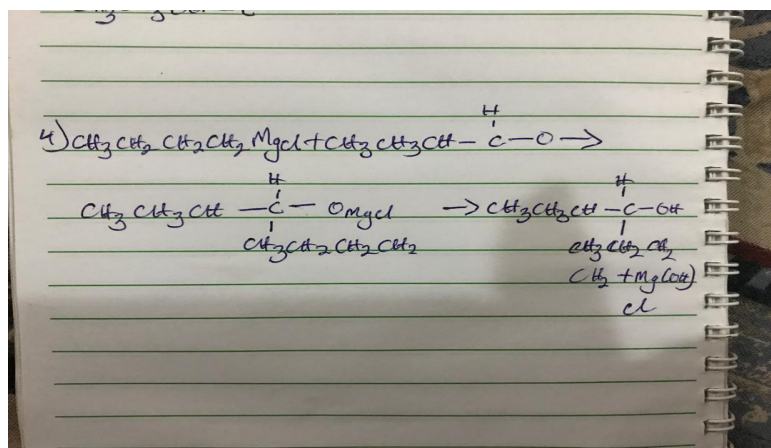
B. Breakdown of maltose: The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of  $15^\circ\text{C}$ .



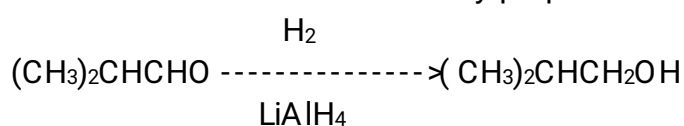
C. Conversion of glucose: The glucose at constant temperature of  $15^\circ\text{C}$  is then converted into alcohol by the enzyme zymase contained in yeast.



4. Reaction between butylmagnesium chloride and 2-methyl propanal



7. Reduction reaction of 2-methylpropanal



8. Scheme for the conversion of propan-1-ol to propan-2-ol

