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Department: Medicine & Surgery

Course Code: CHM 102

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

→ Alcohols are classified using two methods; a) the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group. b) and the number of hydroxyl group they possess.

a). Based on the 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 group are three or two, it is called a primary alcohol (1°), if it is one hydrogen it is called a secondary alcohol (2°), if there are no hydrogen attached to the hydroxyl group it is called a tertiary (3°) alcohol. Examples are: Ethanol (1°) $\{CH_3CH_2OH\}$; Propan-2-ol (2°) $\{CH_3CH(OH)CH_3\}$

b). Based on the number of hydroxyl group they possess: If only one hydroxyl group is present in an alcohol compound, it is said to be monohydric, if there are two hydroxyl it is said to be dihydric (glycols), if they are three it is called trihydric (triols) while polyhydric alcohols (polyols) are alcohols that have more than three hydroxyl group. Example: Propanol (monohydric) $\{CH_3CH_2CH_2OH\}$

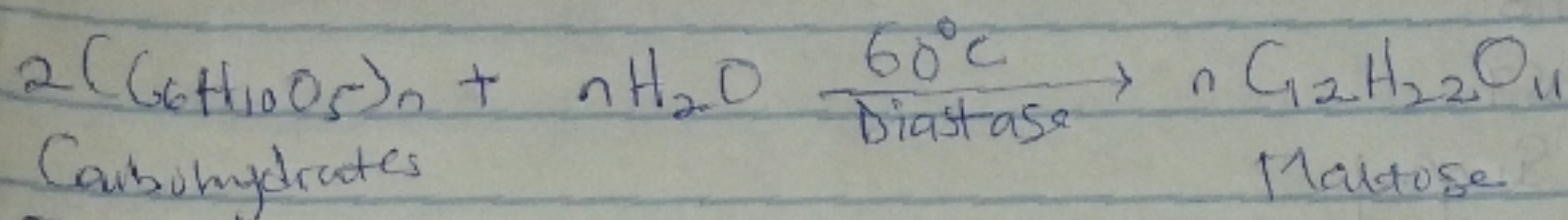
2). Discuss the solubility of alcohols in water, organic solvents.

→ In Water: Alcohols with their carbon atoms up to three are soluble in water. Simple and polyhydric alcohols are soluble in water due to their ability to form hydrogen bonds with water.

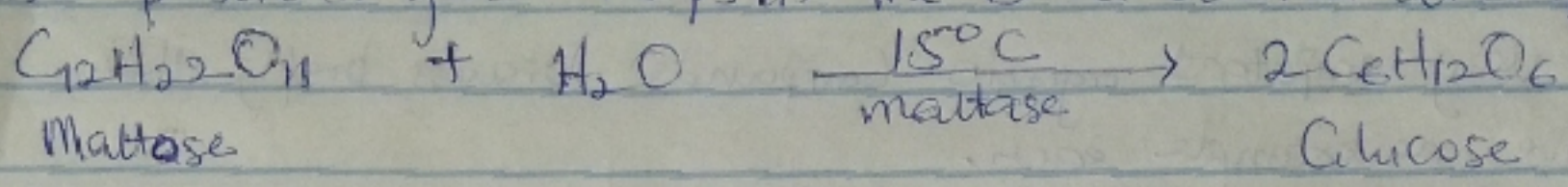
→ In Organic Solvents: Mostly monohydric alcohols that are soluble in organic solvent.

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

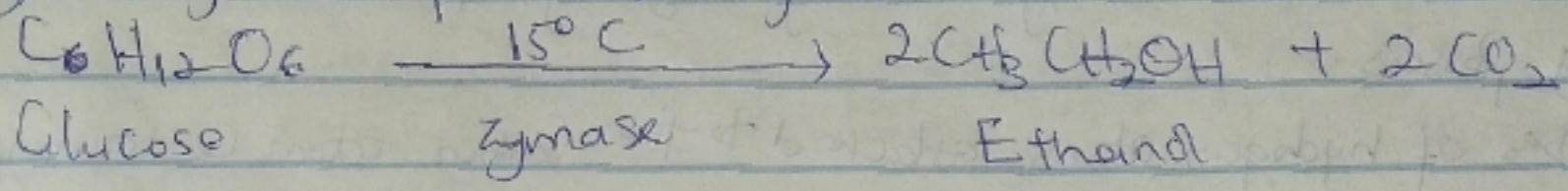
→ Ethanol is produced from the biological fermentation of carbohydrates. The carbohydrates are warmed with malt at $60^\circ C$, this produces maltose with the help of the enzyme, diastase found in the malt.



i) The maltose is broken down to glucose when yeast is added, the enzyme maltase present in yeast helps in the break-down at a temperature of $15^\circ C$

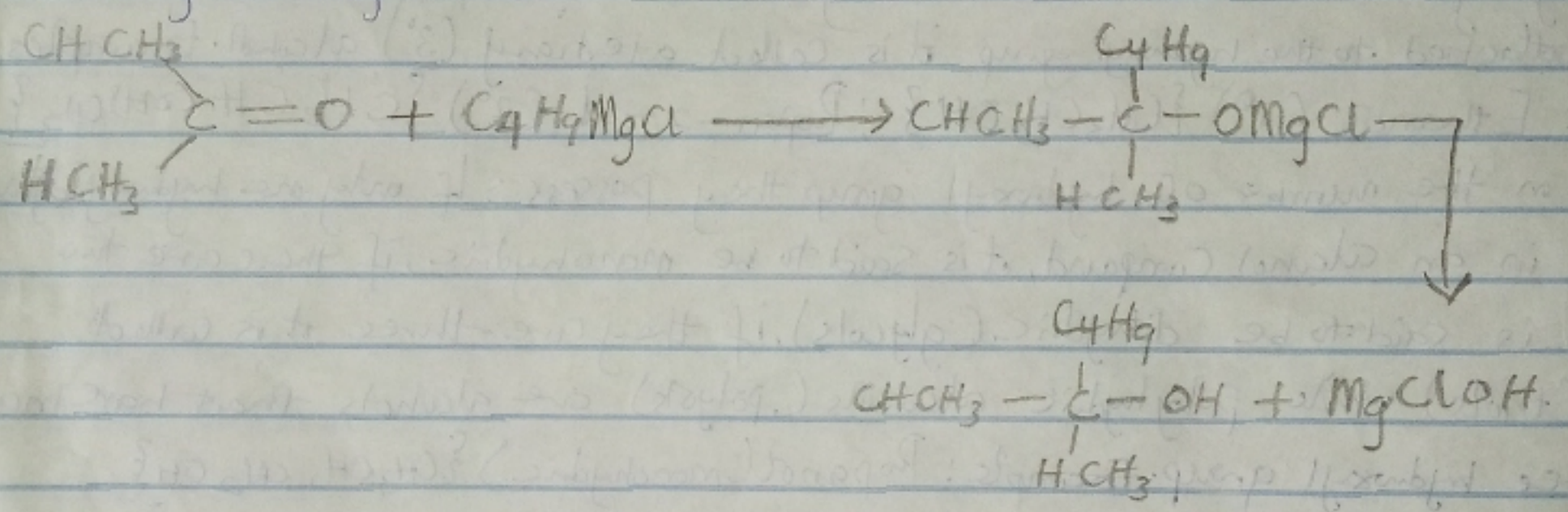


ii) At constant temperature of $15^\circ C$, the glucose is converted to alcohol by the enzyme zymase found in the yeast.

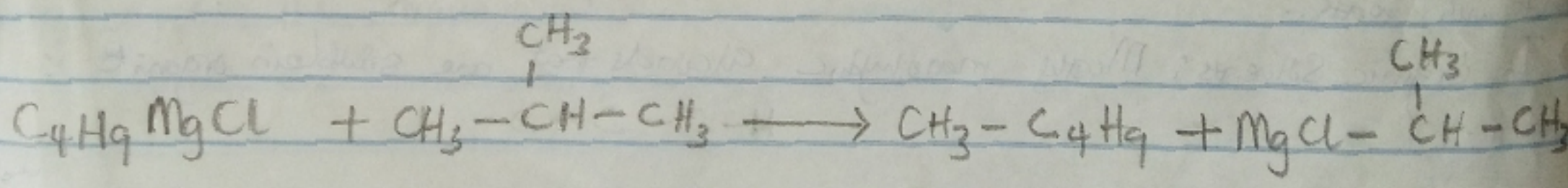


4) Show the reaction between 2-methylpropanal and butyl magnesium chloride

Hint: Grignard synthesis

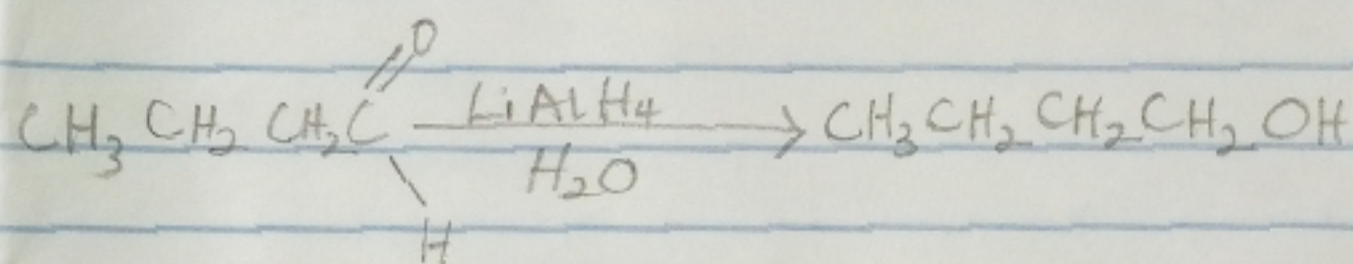


5) Show the reaction between 2-methylpropane and butyl magnesium chloride. Show all structure.



6) Show the reduction reaction of 2-methylpropane.

7) Show the reduction reaction of 2-methylpropanal.



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

