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COURSE: CHM 102.
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ASSIGNMENT.

1.) The classification of Alcohols (and their examples) are:

a) This is based on the number of hydrogen atoms attached to the Carbon atom containing the hydroxyl group. If the numbers of Hydrogen atoms attached to the carbon atom bearing the hydroxyl group are two or three, it is a primary alcohol (1°), if it is one hydrogen atom, it is a secondary alcohol (2°) and if no hydrogen atom is attached to the carbon atom bearing the hydroxyl, it's a tetiary alcohol (3°). Eg: CH_3OH (Methanol; 1°), $CH_3CH_2(OH)CH_3$ (Propan-2-ol; 2°), $(CH_3)_3C-OH$ (2-Methyl propan-2-ol; 3°).

b) This is based on the number of hydroxyl groups they possess. Monohydric alcohols have one hydroxyl group present in the alcohol structure. Dihydric alcohols are also called Glycols have two hydroxyl groups present in the alcohol structure while trihydric alcohols or triols have three hydroxyl groups present in the structure of the alcohols. Polyhydric alcohols or polyols have more than three hydroxyl groups. Eg: $CH_3CH_2CH_2OH$ - Propanol (Monohydric alcohol), $HOCH_2CH_2OH$ - Ethane-1,2-diol (Dihydric alcohol), $OHCH_2CH(OH)CH_2OH$ - Propane-1,2,3-triol (Trihydric alcohol), Hept $CH_3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH_3$ - Heptane-2,3,4,5,6-Pentaol (Polyhydric alcohol).

2) Solubility of alcohols in water, organic solvents.

a) Solubility of alcohols in water: Only lower alcohols with up to three carbon atoms in their molecule can be soluble in water as a result of their ability to form hydrogen bonds with water; the b) Solubility decreases with increase in relative molecular

mass.

6) Solubility of alcohols in organic solvent: 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) Steps in the industrial manufacture of ethanol.

i) Production of ethanol: Carbohydrates such as starch are major group of natural compounds that can be made to yield ethanol by the biological process of fermentation. The biological catalysts, enzymes found in yeast break down the carbohydrate molecules into ethanol to give a yield of 95%.

i) The starch containing materials including molasses, potatoes, cereals, rice and on warming with malt to 60°C for a specific period of time are converted into maltose by the enzyme diastase contained in the malt.

$$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow{60°C/\text{diastase}} nC_{12}H_{22}O_{11}$$

Carbohydrate → Maltose

ii) The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of 45°C.

$$C_{12}H_{22}O_{11} \xrightarrow[15°C/\text{maltase}]{+H_2O} 2C_6H_{12}O_6$$

Maltose → Glucose

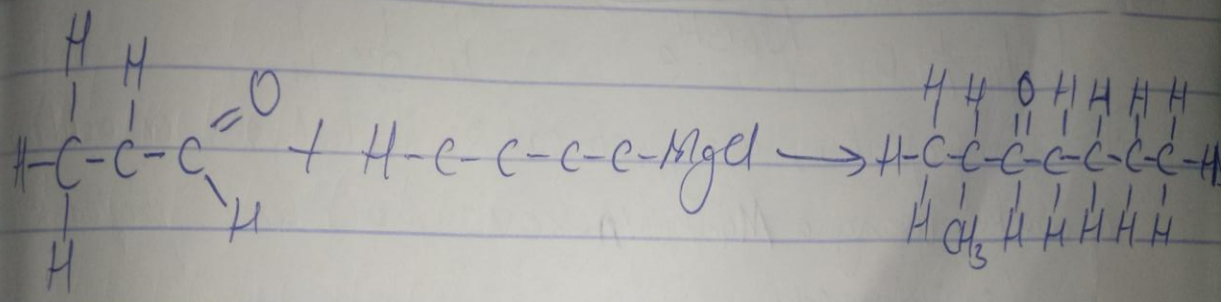
iii) The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme, Zymase contained also in yeast.

$$C_6H_{12}O_6 \xrightarrow{15°C/\text{Zymase}} 2CH_3CH_2OH + 2CO_2$$

Glucose → Ethanol

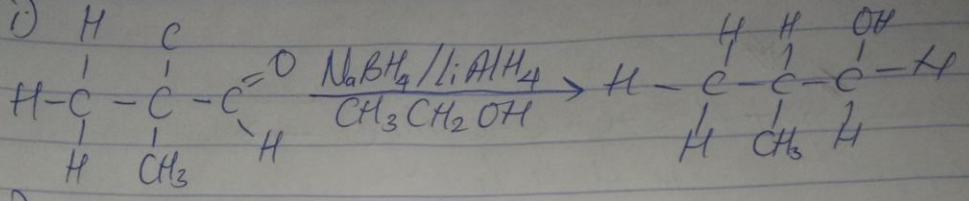
H CH3 H H H H H

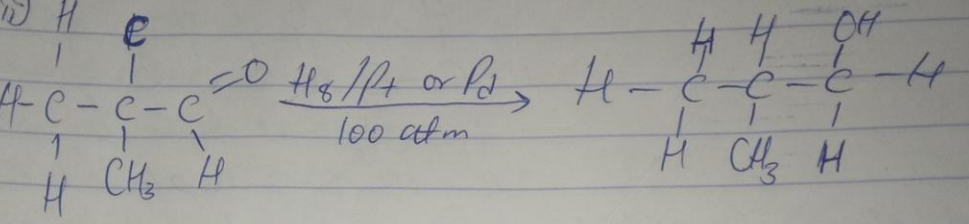
4) Reaction between 2-methyl propanol and butyl magnesium chloride.



2-methyl propanol butyl magnesium Chloride 2-methyl - 3-heptanol.

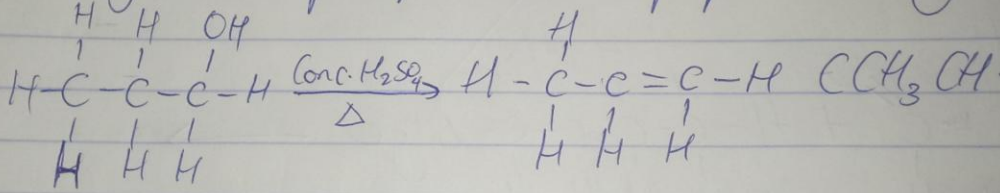
7.) Show the reduction reaction of 2-methyl Propanal

i) 

ii) 

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

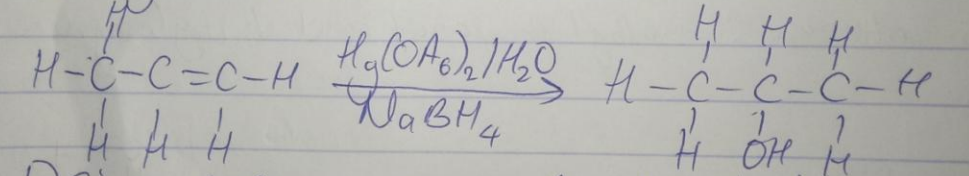
1: Dehydration of Propan-1-ol to propene using Conc. H_2SO_4.



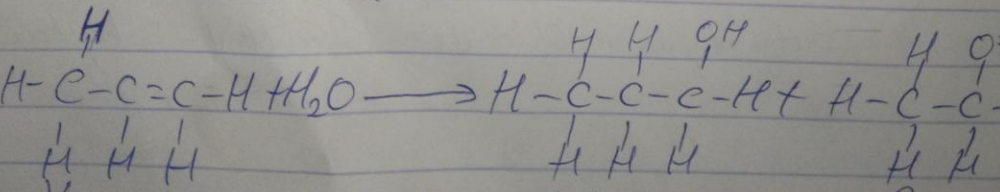
($CH_3CH=CH_2$).

2.) Has two methods:

a) Oxymercuration - Demercuration.



b) Since propene is assymetrical on hydrolysis or addition of water, using a Markovnikov's procedure, propan-2-ol can be obtained.



You would actually get two products: Propan-1-ol; Propan-2-ol. But following Markovnikov's rule, Propan-2-ol would be the major product.