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DEPARTMENT: Nursing

MATRIC NO:19/mhs02/052

Chemistry 102 Assignments

1. **CLASSIFICATION OF ALCOHOLS**

I. Classification 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 three or two, it is a primary alcohol (1^0). If it is one hydrogen atom, it is called a secondary alcohol (2^0) and if no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it is called a tertiary alcohol (3^0). Example: CH_3CH_2OH ethanol(1^0)

II. Classification based on the number of hydroxyl groups they possess. Monohydric alcohols have one hydroxyl group present in the alcohol structure. Dihydric alcohol or Glycols have two hydroxyl groups present in the alcohol structure while trihydric alcohols or triols have three hydroxyl groups present in the alcohol structure. Polyhydric alcohols or polyols have more than three hydroxyl groups. Example: $CH_3CH_2CH_2OH$ propanol (monohydric alcohol).

2. **SOLUBILITY OF ALCOHOLS IN WATER AND ORGANIC SOLVENTS**

In water, 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.
In organic solvents, 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. **INDUSTRIAL PREPARATION OF ETHANOL**

i) Carbohydrate such as starch is broken down by diastase contained in malt at a temperature of 60^0c to give maltose.

Equation: $2(C_6H_{10}O_5)_n + n\ H_2O \xrightarrow{60^0c/diastase} n\ C_{12}H_{22}O_{11}$

carbohydrate — 60^0c/diastase — maltose

ii) Maltose is broken down into glucose by maltase found in yeast at a temperature of 15^0c to give glucose.

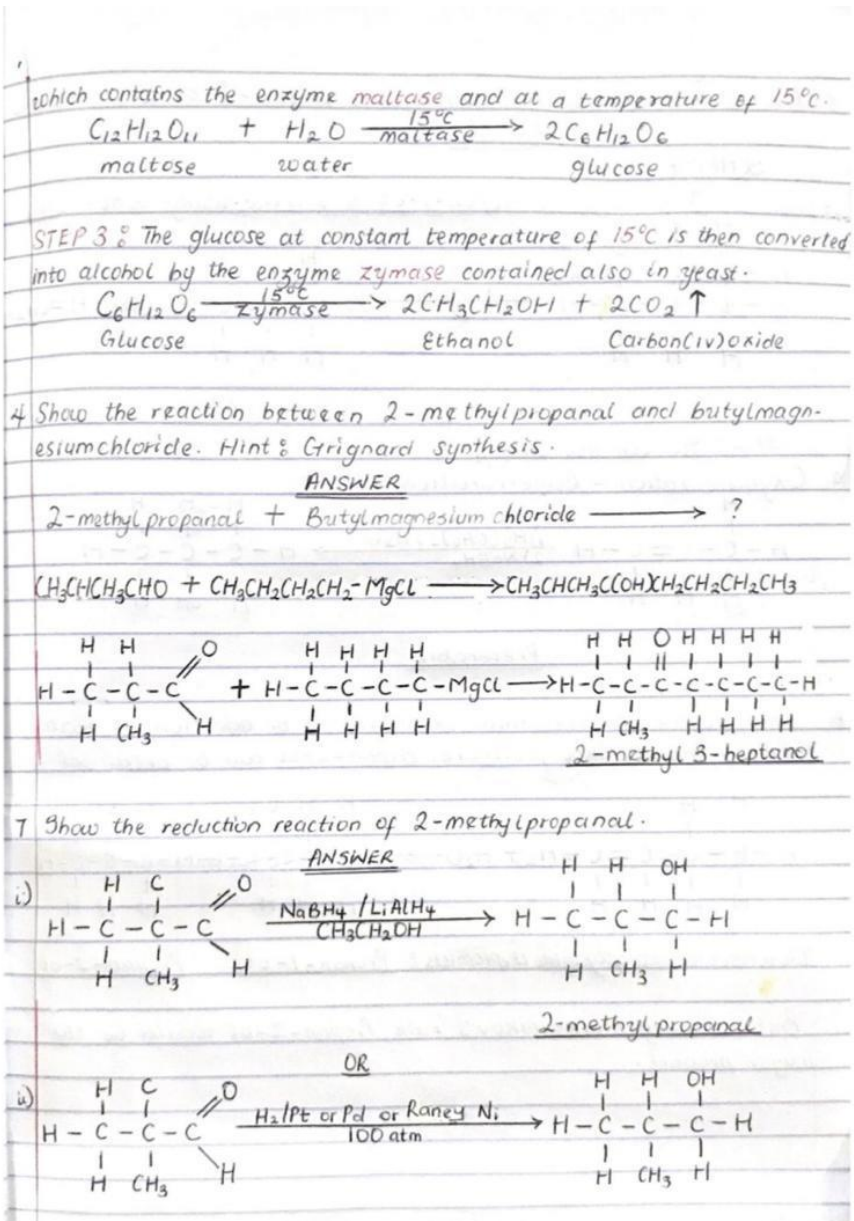
Equation: $C_{12}H_{22}O_{11} + H_2O \longrightarrow 2C_6H_{12}O_6$

Maltose 15^{0}c/maltase glucose

iii) Glucose is converted to ethanol at constant temperature of 15^{0}c by enzyme zymase also contained in yeast.

Equation: $C_6H_{12}O_6 \longrightarrow 2CH_3CH_2OH + 2CO_2$

Glucose 15^{0}c/zymase Ethanol



which contains the enzyme maltase and at a temperature of 15°c.

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

maltose water glucose

STEP 3: The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme zymase contained also in yeast.

$$C_6H_{12}O_6 \xrightarrow[\text{zymase}]{15°c} 2CH_3CH_2OH + 2CO_2 \uparrow$$

Glucose Ethanol Carbon(iv)oxide

4 Show the reaction between 2-methylpropanal and butylmagnesiumchloride. Hint: Grignard synthesis.

ANSWER

2-methyl propanal + Butylmagnesium chloride ⟶ ?

$$CH_3CHCH_3CHO + CH_3CH_2CH_2CH_2-MgCl \longrightarrow CH_3CHCH_3C(OH)CH_2CH_2CH_2CH_3$$

2-methyl 3-heptanol

7 Show the reduction reaction of 2-methylpropanal.

ANSWER

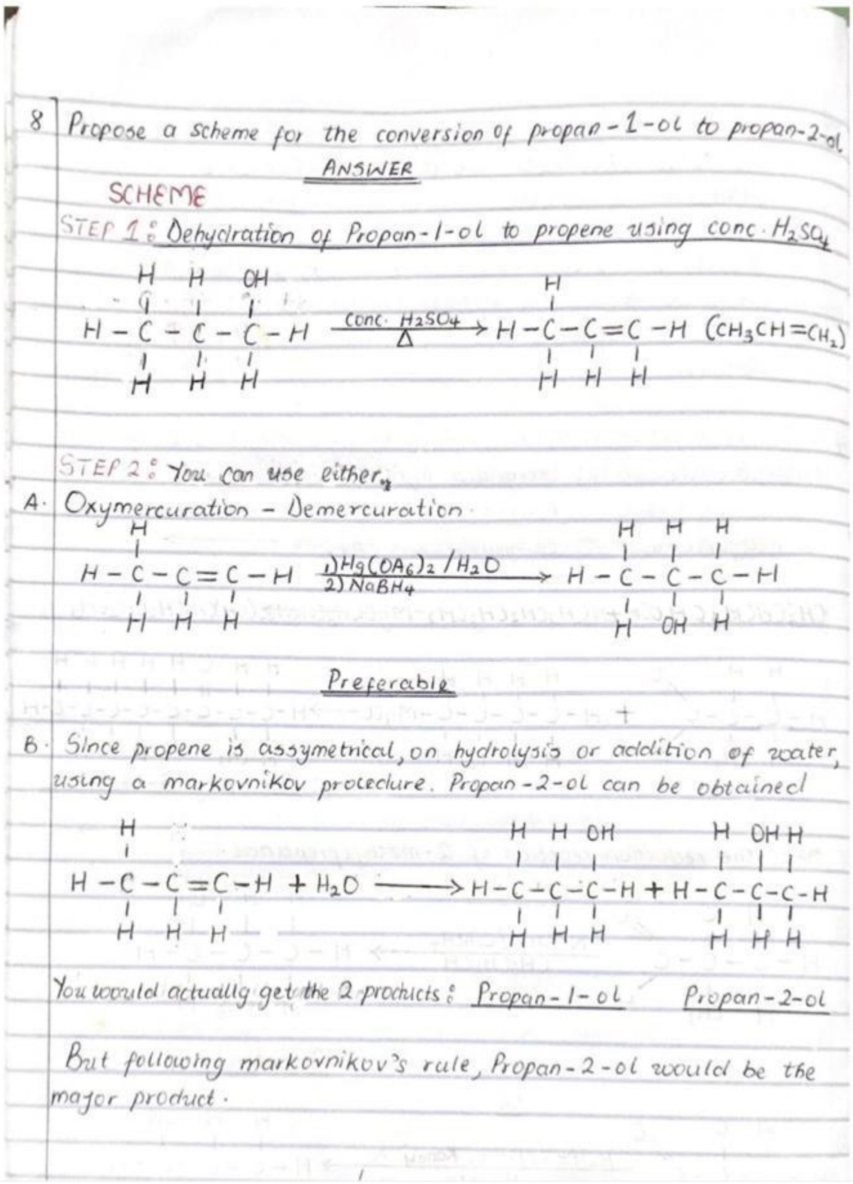
i) NaBH$_4$ / LiAlH$_4$, CH$_3$CH$_2$OH

2-methyl propanal

OR

ii) H$_2$/Pt or Pd or Raney Ni, 100 atm

4.



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

ANSWER

SCHEME

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

$$CH_3CH_2CH_2OH \xrightarrow[\Delta]{conc.\ H_2SO_4} CH_3CH=CH_2 \quad (CH_3CH=CH_2)$$

STEP 2: You can use either,

A. Oxymercuration - Demercuration

$$CH_3CH=CH_2 \xrightarrow[2)\ NaBH_4]{1)\ Hg(OAc)_2\ /\ H_2O} CH_3CH(OH)CH_3$$

Preferable

B. Since propene is assymetrical, on hydrolysis or addition of water, using a markovnikov procedure. Propan-2-ol can be obtained

$$CH_3CH=CH_2 + H_2O \longrightarrow CH_3CH_2CH_2OH + CH_3CH(OH)CH_3$$

You would actually get the 2 products: Propan-1-ol   Propan-2-ol

But following markovnikov's rule, Propan-2-ol would be the major product.

8.