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19/MHS01/334 CHM 102 Assignment 4.

(1.) Classification of Alcohols:

(1a) Based on Hydrogen atoms attached to the carbon atom containing the hydroxyl group.

1ai Primary Alcohol (1°) :- If the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two, it is called a primary alcohol. Example. CH_3OH - Methanol (1°).

(aii) Secondary Alcohol (2°) :- A Secondary alcohol is formed, when the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group is ONE. Example $CH_3CH(OH)CH_3$ - Propan-2-ol (2°)

(aiii) Tertiary Alcohol (3°) :- IF NO HYDROGEN ATOM is attached to the Carbon atom bearing the hydroxyl group. It is called Tertiary alcohol example :- $(CH_3)_3C-OH$ 2-Methyl propan-2-ol (3°)

(1b) Based on the Number of hydroxyl groups they possess

(bi) Monohydric Alcohols :- They have ONE HYDROXYL GROUP present in the alcohol Structure. Example :- $CH_3CH_2CH_2OH$ - Propanol

(bii) Dihydric Alcohols :- They are also called Glycols. They have two hydroxyl groups present in the alcohol structure e.g $HOCH_2CH_2OH$ - Ethane-1,2-diol.

(biii) Polyols have more three hydroxyl groups for example;
$CH_3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH_3$ - Heptane-2,3,4,5,6-pentaol (polyhydric alcohol).

2. Solubility of alcohols in Water and in Organic sowents

Alcohols are souble in water. This is due to the hydroxyl group in the alcohol which is able to form hydrogen bonds with water molecules. Alcohols with a smaller hydrocarbon chain are very soluble. As the length of the hydrocarbon chain increases, the solubility in water decreases. With four Carbon in the hydrocarbon chain and higher, the decrease in Solubility becomes visible as the mixture forms two

immiscible liquid layers. The reason why solubility decreases as the length of HC chain increases is because it requires more energy to overcome the hydrogen bonds between the alcohol molecules as they are tightly packed together as the size of mass increases. All monohydric alcohols are soluble in organic solvents. The solubility of simple alcohols and polyhydric alcohol is largely due to their ability to form hydrogen bonds with water molecules.

Industrial Production of Alcohols.

STEP 1 :- Fermentation

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 breaks down the carbohydrate molecules into ethanol to give a yield of 95%. The starch containing materials include 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.

$$2(C_6H_{10}O_5)_n + nH_2O \longrightarrow nC_{12}H_{22}O_{11}$$

Carbohydrate — 60°C/diastase — Maltose

STEP 2

The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of 15°C

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

maltose — 15°/maltase — glucose

STEP 3

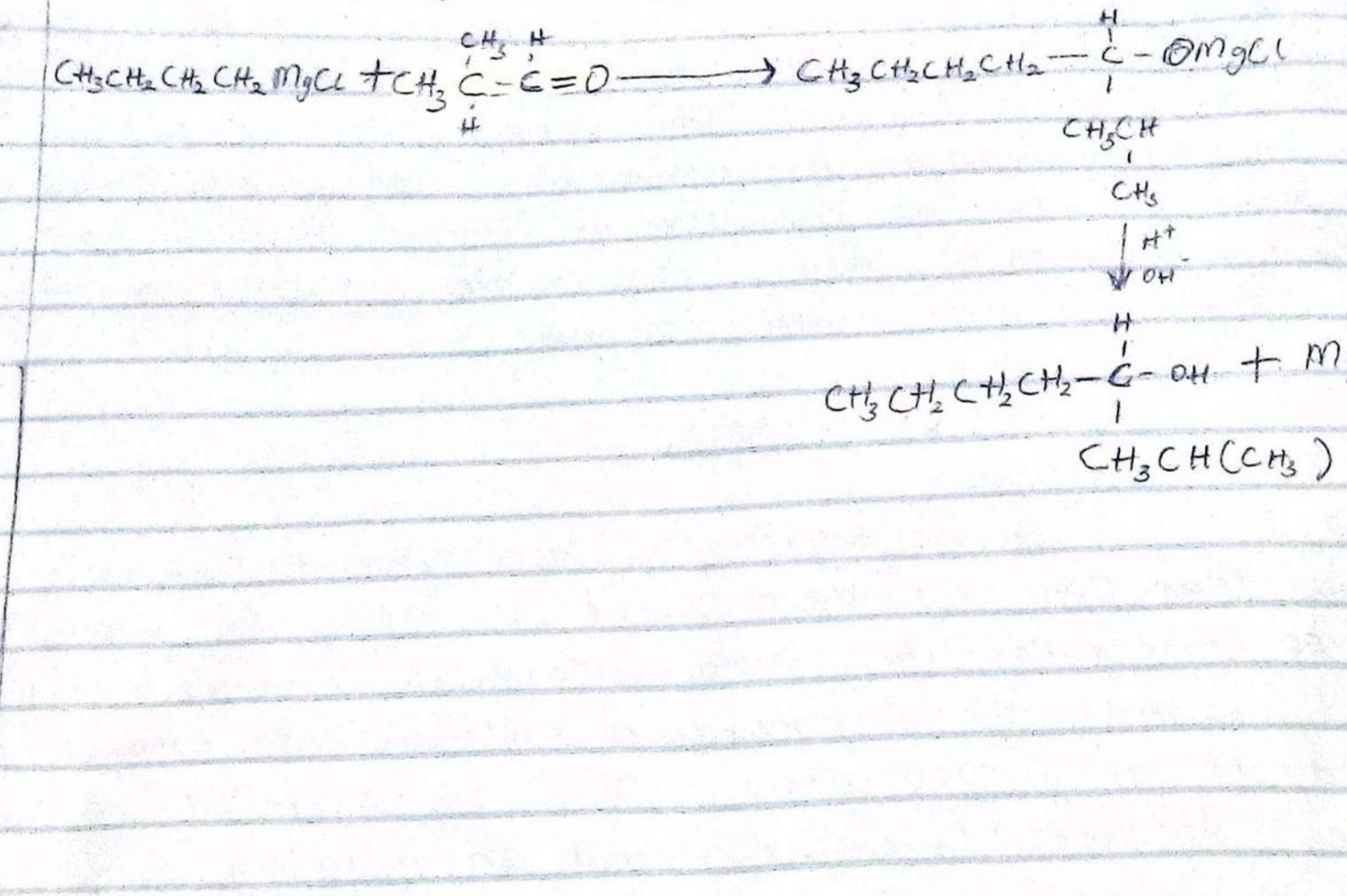
The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme zymase contained also in yeast

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

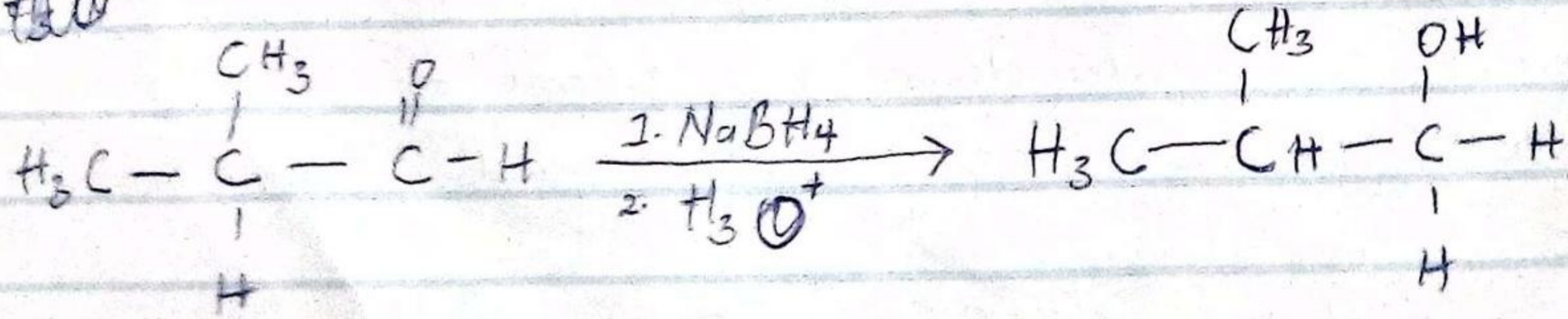
Glucose — 15°C/Zymase — Ethanol

Grignard Synthesis using butyl magnesium chloride and 2 methyl propanal

(A) $CH_3CH_2CH_2CH_2MgCl + CH_3CH_3CHCHO$



7 Reduction reaction of 2-methyl propanal. [using Sodium tetrahydro Borate in water



2 - Methyl propanal

2 - Methyl Propanol

(3) Conversion of Propan-1-ol to Propan-2-ol

* Dehydrate Propan-1-ol using H_2SO_4

$$CH_3CH_2CH_2OH + H_2SO_4 \longrightarrow CH_3CH_2CH_2OH_2OSO_3H$$

$$\downarrow -H_2O$$

$$CH_3CH_2CH_2OSO_3H$$

* $CH_3CH_2CH_2OSO_3H \xrightarrow{-H_2SO_4} CH_3CH=CH_2$

Propyl hydrogen sulphate — propene

* $CH_3CH=CH_2 + H_2O \longrightarrow CH_3CHCH_3OH$

propene — Propan-2-ol.