

UKADMA NPEOMA GEM

19/MAY/2015

CHM 102 ASSIGNMENT

1. Discuss briefly the classification of alcohol and give one example each.

A. Alcohols are classified based on number of hydroxy groups contained per molecule. Thus:

- i. Monohydric alcohol contain just one hydroxy group in a molecule. Examples are ethanol ($\text{C}_2\text{H}_5\text{OH}$)
- ii. Dihydric alcohol contain two (2) hydroxy groups per molecule. Example is ethane-1,2-diol ($\text{C}_2\text{H}_4(\text{OH})_2$)
- iii. Trihydric alcohol contain three (3) hydroxy groups per molecule. Example is Propane-1,2,3-triol ($\text{C}_3\text{H}_8(\text{OH})_3$)

B. Alcohols can also be classified based on the number of hydrogen atoms attached to the carbon atom containing the hydroxy group. Thus:

- i. Primary alcohol (1°): Here the number of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three (3) or two (2). Example is ethanol ($\text{C}_2\text{H}_5\text{OH}$)
- ii. Secondary alcohol (2°): This is when the number of hydrogen atom attached to the carbon atom bearing the hydroxyl group is one (1). Example is Propan-2-ol ($\text{C}_3\text{H}_7\text{OH}$)
- iii. Tertiary alcohol (3°): This is when the number of hydrogen atom attached to the carbon atom bearing the hydroxyl group is zero (0). Example is 2-methylpropan-2-ol
$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{C} - \text{OH} \\ | \\ \text{CH}_3 \end{array}$$

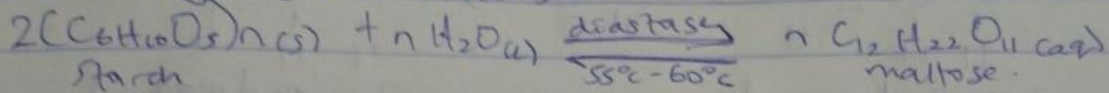
2. Discuss the solubility of alcohols in water, organic solvents
Lower alcohols with up to three (3) carbon atoms in their molecules are soluble in water because these lower alcohols can form hydrogen bonds with water molecules and all monohydric alcohols are soluble in organic solvents. The water solubility of alcohols decreases with increasing

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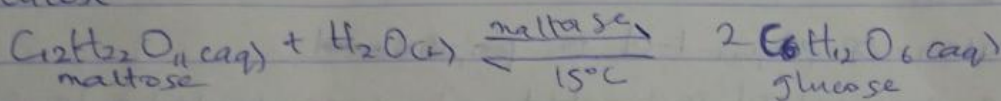
relative molecular mass

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

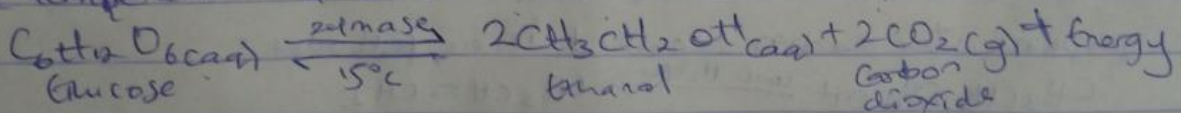
i) The starchy material (eg potato) is crushed and pressure cooked to release starch granules. Then malt (a partially germinated barley) is added and the temperature is maintained at $55^{\circ}\text{C} - 60^{\circ}\text{C}$ for one (1) hour. The enzyme diastase which is contained in malt hydrolyses starch into a sugar called maltose.



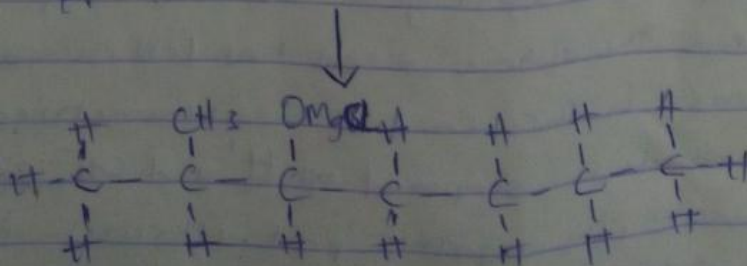
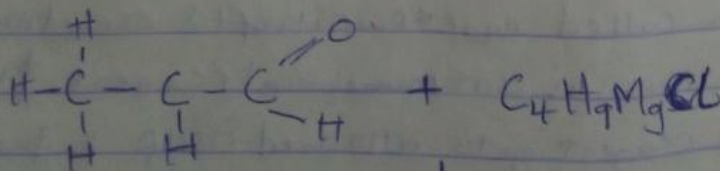
ii) The liquid is cooled to about 15°C and yeast added. The enzyme maltase (contained in yeast) hydrolyses maltose to glucose.

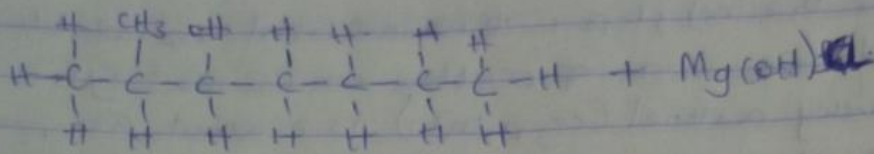
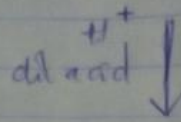


iii) Finally the enzyme zymase (also contained in yeast) decomposes glucose into ethanol and carbon (iv) oxide at a temperature of 15°C .

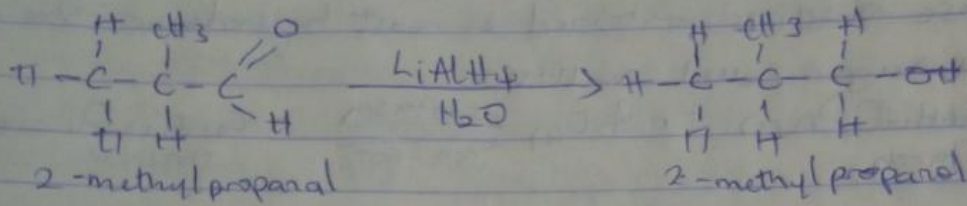


4 Show the reaction between 2-methyl propanal and butylmagnesium chloride:





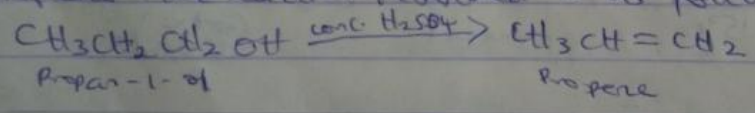
7) Show the reduction of 2-methyl propanal



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

a) Dehydration of propan-1-ol to propene.

When propan-1-ol is treated with concentrated sulphuric acid (H_2SO_4) the phenomenon called dehydration occurs due to which a water molecule from propan-1-ol gets eliminated. Due to this, propan-1-ol gets converted into propene. The reaction involved is as follows -



b) Hydrolysis of propene to propan-2-ol.

Propene can be hydrolysed to propan-2-ol in accordance with the mechanism called Markovnikov's reaction which states that when an unsymmetrical reagent the negative part of the reagent gets attached itself to the carbon atom of the alkene which has less number of hydrogen atoms. In this case, the unsymmetrical reagent used is H_2O which is composed of H^+ and OH^- part. Due to hydrolysis of water, the negative part attaches itself to the propene and thus converts it as propan-2-ol. The reaction is as follows:

$$\text{CH}_3-\text{CH}=\text{CH}_2 \xrightarrow{\text{H}_2\text{O}} \text{CH}_3-\text{CH}_2-\text{OH}-\text{CH}_3$$

Propene
Propan-2-ol