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Pharmacy

MHS

Chemistry 102 Assignment Answers

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1 Alcohols may be classified as primary, secondary or tertiary according to which carbon of the alkyl group is bonded to the hydroxyl group. Most alcohols are colourless liquids or solids at room temperature.

Primary Alcohols

In a primary (1°) alcohol, the carbon which carries the -OH group is only attached to one alkyl group. If the number of hydrogen atoms attached to the carbon bearing the hydroxyl group is two or three then it is a primary alcohol. And example of primary alcohols include:
CH3-CH2-OH(Ethanol)

Secondary Alcohols

In a secondary (2°) alcohol, the carbon with the -OH group attached is joined directly to two alkyl groups, which may be the same or different. If the number of hydrogen atom attached to the carbon bearing the hydroxyl group is one then it is a secondary alcohol. An example is propan-2-ol

Tertiary Alcohols

In a tertiary (3°) alcohol, the carbon atom holding the -OH group is attached directly to three alkyl groups, which may be any combination of same or different. If there are no hydrogen atoms attached to the carbon bearing the hydroxyl group then it is a secondary alcohol. An example is 2-methyl-propan2-ol.

2 Alcohols are soluble 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. Lower alcohols are more soluble in water than higher alcohols. With the increase in the molar mass, solubility decreases. In alcohols, the -OH group is polar and forms hydrogen bonds with water. This makes alcohol water soluble. Why large alcohols are not soluble in water is because all you get in place of those original hydrogen bonds are van der Waals dispersion forces between the water and the hydrocarbon 'tails'. These attractions are much weaker. That means that you don't get enough energy back to compensate for the hydrocarbon bonds being broken.

3 Industrial production of Ethanol

- Carbohydrates such as starch are major group of natural compounds that can be made to yield ethanol by the process called FERMANTATION. Yeasts

contains some enzymes which helps to break down carbohydrate molecules into ethanol to give a yield of 95%. Malt is then warmed to 60°c with chemical substances such as molasses, cereals and potatoes. This is done for a specific period of time which then produces MALTOSE by the enzyme disease contained in the malt.

The equation is as follows;

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

Carbohydrate 60°c/diastase Maltose

- The maltose is then broken down into GLUCOSE on addition of The enzymes which are found in Yeast at a temperature of 15°c

The equation is as follows;

$C_{12}H_{22}O_{11} + H_2O \xrightarrow{15°c/maltose} 2C_6H_{12}O_6$

Maltose 15°c/maltose Glucose

- The glucose is then converted into ALCOHOL by Zymase which is an enzyme.

The equation is as follows;

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

Glucose 15°c/Zymase Ethanol

4.$(CH_3)_2CHCH{=}O + C_4H_9MgCl \longrightarrow C_4H_9CH(CH_3)_2CH\text{-}OMgCl$

C4H9CH(CH3)2CH-OMgCl + H2O ——>
C4H9CH(CH3)2CH-OH + MgClOH

5.(CH3)2CH2C=O + C4H9MgCl ——> C4H9(CH3)2C-OMgCl

C4H9(CH3)2C-OMgCl ———————> C4H9CH2(CH3)2C-OH
H2O/Dilute acid
+
MgClOH

6.(CH3)2CHCH=O ———————> (CH3)2CHCH2OH
2 Methyl propanal

7.(CH3)2CH2C=O ———————> (CH3)2CHCH2OH

8. **Conversion of propan-1-ol to propan-2-ol**

When **propan-1-ol** is treated with concentrated sulfuric acid. the phenomenon called dehydration occurs due to which a water molecule from **propan-1-ol** gets eliminated.

To convert propan-1-ol to propan-2-ol

Things required:

- Concentrated sulfuric acid (H2SO4)
- Water

Process involved:

- Dehydration of propan-1-ol to propene.
- Hydrolysis of propene to propan-2-ol

Steps:

- Dehydration of propan-1-ol to propene.

When propan-1-ol is treated with concentrated sulfuric 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:

$$CH_3CH_2CH_2OH \xrightarrow[\text{Conc } H_2SO_4]{} CH_3CH=CH_2$$

- Hydrolysis of propene to propan-2-ol.

Propene can be hydrolyzed to propan-2-ol in accordance with mechanism called as Markownikoffs addition. It 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 in 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 convert it as propan-2-ol.The reaction involved is as follows:

$$CH_3–CH=CH_2 \longrightarrow CH_3–CH_2–OH–CH_3$$