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ASSIGNMENT 5(NEW ASSIGNMENT)

1. Alcohols are very important organic compounds. Discuss briefly their classification and give one example each.

a. Alcohols can be classified based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group. Example CH3CH2OH (Ethanol 1), CH3CH(OH)CH3(Propan-2-ol 2o), (CH3)3C-OH (2-Methylpropan-2-ol 3o).

b. This is based on the number of hydroxyl groups they posses

i. Monohydric alcohol-having only one hydroxyl group CH3CH2CH2OH-Propanol.

ii. Dihydric alcohol-having two hydroxyl group (Glycol) HOCH2CH2OH-Ethane-1,2-diol.

Iii. Trihydric alcohol-having three hydroxyl groups(Triol) OHCH2CH(OH)CH2OH-Propan-1,2,3-triol.

iv. Polyhydric alcohol-having more than three hydroxyl group(Polyol).

1. Discuss the solubility of alcohols in water, organic solvents.

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.

1. Show the three steps in the industrial manufacture of ethanol. Equations of reaction are mandatory.

a.2(C6H10O5)n + nH2O 60OC/diastase nC12H22O11

Carbohydrate maltose

The starch containing materials include molasses, potatoes, cereals, rice and on warning with malt of 60oC for a specific period of time are converted into maltose by the enzyme diastase contained in the malt.

b. C12H22O11 + H2O 15OC/maltase 2C6H12O6

maltose Glucose

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

c. C6H12O6 15OC/zymase 2CH3CH2OH + 2CO2

Glucose Ethanol

4.Show the reaction between 2-methylpropanal and butylmagnesium chloride. Hint: Grignard synthesis. Note: Show all structures.

H CH3 O H CH3 OMgCl

H C C C + C4H9MgCl H C C C C4H9

H H H Butylmagnesiumchloride H H H

DiL.acid

H CH3 OH

Mg(OH)Cl + H C C C C4H9

H H H

5 and 6 are incorrect

7. Show the reduction of 2-methylpropanal (isobutyaryaldehyde).

Isobutyaldehyde (CH3)2CHCHO [C4H8]. It can be manufactured often as a side-product by the hydroformylation of propene. It undergoes the Cannizzaro reaction even though it has an alpha hydrogen atom. Hence, due to step B being sterically hindered, the aldol product ends up being a minor product, giving the major product title to the Cannizzaro product instead. The hydrogenation is supposed to reduce the compound by adding two hydrogens somewhere. The easiest place to add them is wherever the molecule is most electrophilic, so it would have to be across the carbonyl group. The C O bond has the most electron density and oxygen’s higher electronegativity polarizes the bond to be partially positively charged nearer the carbon.

H H O H H OH H

H C C C H2(Ni or Pt) Cat H C C C C H

H H or LiAlH4 H H H H

H C H

H

2-Methylpropanal

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

CH3CH2CH2OH + H2SO4 CH3CH2CH2OH2OSO3H

PROPAN-1-OL

CH3CH2CH2OSO3H

-H2SO4

CH3CH2=CH2 PROPENE

-H+ OH-

CH3CHCH3

OH PROPAN-2-OL