NAME: ALUGAH- DAVID FAVOUR

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DEPARTMENT: NURSING

COURSE: CHEMISTRY 102

**ASSIGNMENT**

Q1. Discuss the two major classification of alkanols. Give two examples each for each class.

Q2. In the Grignard synthesis of Alkanols, react a named Grignard reagent with CH3CH2CH2CH2C=OCH2CH2CH3. Show the reaction steps.

Q3. Discuss the industrial manufacture of ethanol showing all reaction equations and necessary enzymes and temperature of reaction.

Q4. Determine the product obtained in the reduction of alkanone and alkanal. Use a specific example for each and show the equation of reaction.

**SOLUTION**

Q1. Classification of alkanols: one way of classifying alkanols is based on which carbon atom is bonded to the hydroxyl group.

a) Primary alkanol: This is when the carbon is primary(1o) ie bonded to only one other carbon atom, the compound is primary. Eg; CH3OH~methanol, SCH3CH2OH~ethanol.

b) Secondary alkanol: It has the hydroxyl group on a secondary(2o) carbon atom, which is bonded to two other carbon atoms. Eg; CH3CH(OH)CH3~propan-2-ol, CH3CH(OH)CH2CH3~butan-2-ol.

c) Tertiary alkanol: It has the hydroxyl group on a tertiary (30) carbon atom, which is bonded to three other carbons. Eg; (CH3)3C-OH~2-Methylpropan-2-ol

Another way of classifying alkanols is classification based on the number of hydroxyl groups present. Monohydric alkanol have one hydroxyl group present in the alcohol structure. Dihydric alcohols are also known as glycols, they have two hydroxyl group present in the structure while trihydric alcohols or triols have three OH groups present in the structure of the alcohol. Polyhydric alcohols or polyols have more than three OH groups.

Examples;

CH3CH2CH2OH~propanol (Monohydric alcohol)

HOCH2CH2OH~Ethane-1,2-diol (Dihydric alcohol)

OHCH2CH(OH)CH2OH~propane-1,2,3-triol (Trihydric alcohol)

CH3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH3~Heptane-2,3,4,5,6-pentanol (polyhydric alcohol)

Q2. Grignard synthesis of alkanols

Grignard reagent- C2H5MgBr

CH3CH2CH2CH2-C=OCH2CH2CH3+ C2H5MgBr

C2H5 H2O C2H5

CH3CH2CH2CH2 -C-O MgBr CH3CH2CH2CH2-C-OH

CH2CH2CH3 CH2CH2CH3

+Mg(OH)Br

Q3. Industrial manufacture of ethanol: Ethanols are produced from carbohydrates through the biological process called fermentation. The biological catalysts/enzymes found in yeast breakdown the carbohydrate molecules into ethanol. The starch containing materials include molasses, potatoes, cereals, rice and on warming with malt to 60oC for a specific period of time are converted into maltose by the enzyme diastase contained in the malt.

2(C6H10O5)n + nH2O nC12H22O11

Carbohydrate 600C/diastase (maltose)

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

C12H22O11+H2O 2C6H12O6

Maltose 15oC/maltase glucose

The glucose at constant temperature of 150C is then converted into alcohol by the enzyme zymase contained also in yeast

C6H12O6 2CH3CH2OH+2CO2

Glucose 150C/zymase ethanol

Q4. The product obtained in the reduction of alkanone (ketones) is secondary alcohol. OH

Eg; CH3CH2C=O H2/Ni CH3CH2CH-CH3

CH3  secondary alcohol

The product obtained in the reduction of alkanal (aldehyde) is primary alcohol.

Eg; CH3CH2C=O LiAlH4 CH3CH2CH2OH

H H2O primary alcohol