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19/SCI14/004

SCIENCES/GEOLOGY

CHEM102 ASSIGNMENT

QUESTIONS

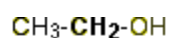
- 1) Discuss the two major classification of Alkanols. Give two Examples each for each class
- 2) In the Grignard synthesis of Alkanols, react a named Grignard reagent with $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{C}=\text{OCH}_2\text{CH}_2\text{CH}_3$. Show the reaction steps.
- 3) Discuss the industrial manufacture of ethanol showing all reaction equations and necessary enzymes and temperature of reaction
- 4) Determine the product obtained in the reduction of Alkanone and Alkanal. Use a specific example for each and show the equation of reaction

Answers

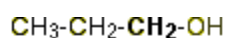
Question 1

Primary Alcohols

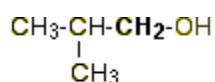
Primary alcohols are those alcohols where the carbon atom of the hydroxyl group (OH) is attached to only one single alkyl group. Some of the examples of these primary alcohols include Methanol (, propanol, ethanol, etc. The complexity of this alkyl chain is unrelated to the classification of any alcohol considered as primary. The existence of only one linkage among –OH group and an alkyl group and the thing that qualifies any alcohol as a primary.



ethanol



propan-1-ol



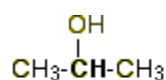
2-methylpropan-1-ol

Primary Alcohols – Examples

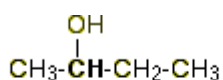
2. Secondary Alcohols

Secondary alcohols are those where the carbon atom of the hydroxyl group is attached to two alkyl groups on either side. The two alkyl groups present may be

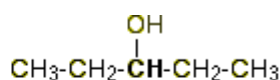
either structurally identical or even different. Some of the examples of secondary alcohols are given below-



propan-2-ol



butan-2-ol

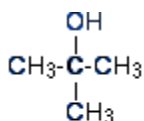


pentan-3-ol

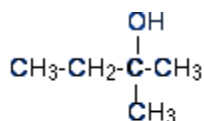
Secondary Alcohol – Examples

3. Tertiary Alcohols

Tertiary alcohols are those which feature hydroxyl group attached to the carbon atom which is connected to 3- alkyl groups. The physical properties of these alcohols mainly depend on their structure. The presence of this -OH group allows the alcohols in the formation of hydrogen bonds with their neighbouring atoms. The bonds formed are weak, and this bond makes the boiling points of alcohols higher than its alkanes. The examples of tertiary alcohols include-



2-methylpropan-2-ol

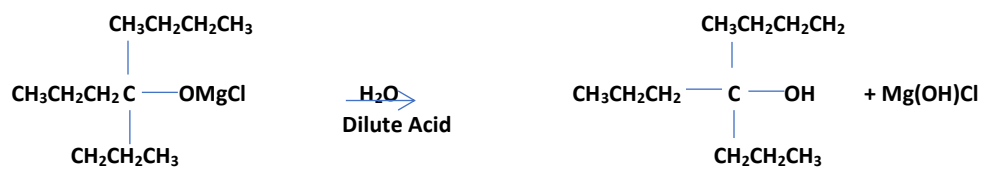
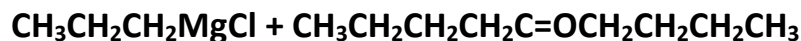


2-methylbutan-2-ol

Tertiary Alcohol – Examples

Question 2

In the Grignard synthesis of Alkanols, react a named Grignard reagent with $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{C}=\text{OCH}_2\text{CH}_2\text{CH}_3$. Show the reaction steps.



4Propyloctan-4-ol

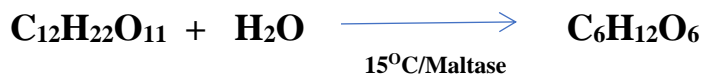
QUESTION 3

INDUSTRIAL MANUFACTURE OF ETHANOL

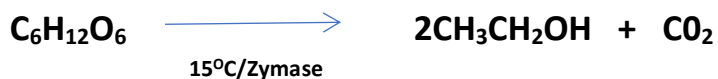
Carbohydrate is converted into Maltose at a temperature of 60°C and by the enzyme diastase



Maltose is broken into glucose on addition of yeast which contains the enzyme maltase at 15°C



Glucose at constant temperature 15°C is converted into alcohol with enzyme zymase contained also in yeast



QUESTION 4

Reduction of Alkanones and Alkanals

Both alkanals and alkanones can undergo reduction using hydrogen gas and a catalyst, or a metal hydride reducing reagent.

In effect we are adding a hydrogen atom (H) to the carbon of the carbonyl functional group, and, to the oxygen present in the carbonyl functional group (C=O) to produce a new functional group, the hydroxyl functional group (OH).

When we do this to an alkanal, R-CHO, the hydroxyl group will be present at the end of the carbon chain and hence a primary alkanol is produced, R-CH₂OH.

When we do this to an alkanone, R-CO-R', the hydroxyl group will be present, not at the end of a chain, but somewhere between the ends of the chain, R-CH(OH)-R'. The hydroxyl group will be present on a carbon atom which is itself covalently bonded to 2 other carbon atoms, therefore this will be a secondary alkanol.

- The reduction of an alkanal produces a primary alkanol.
- The reduction of an alkanone produces a secondary alkanol.

For example, using a platinum catalyst with hydrogen gas under pressure, we can convert butanal to butan-1-ol, and we can convert butanone to butan-2-ol using a nickel catalyst as shown below:

