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# COURSE CHM102, CHEMISTRY.

**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 CH3CH2CH2CH2C=OCH2CH2CH3.
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**

1). The two major ways of classification of Alkanols include;

1. Classification based on the number of alkyl group or hydrogen atoms. Alkanols have a general molecular formula of ROH or CnH2n+1 where R is the alkyl group and OH the hydroxyl group which is the major functional group for alkanols

There are two groups under this classification;

1. Primary alkanols: When the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two it is called a primary alkanol examples are CH3OH (Methanol), CH3CH3CH2OH (Ethanol).
2. **Secondary alkanols:** If the numbers of hydrogen atoms attached to the carbon atom bearing hydroxyl group is one hydrogen atom it is called a secondary atom examples; CH3CH(OH)CH3 (Propan-2-ol).
3. **Tertiary alkanol:** If there’s no hydrogen atom attached to the carbon atom bearing the hydroxyl group, it is called a tertiary alkanol. Example (CH3)3C-OH (2-Methylpropan-2-ol.
4. **Classification based on the number of hydroxyl groups they possess:**
5. **Monohydric alkanols:** They possess one hydroxyl group present in the alkanol structure examples; CH3CH2CH2OH (Propanol).
6. **Dihydric alkanols:** They are also known as **Glycols,** have two hydroxyl group present in the alkanol structure. Examples; HOCH2CH2OH (Ethane-1,2-diol), CH3CH(OH)CH2CH(OH)CH2CH2 (Hexane-2,4-diol).
7. **Trihydric alkanols:** Also known as **Triols,** have three hydroxyl groups present in their structure. Examples; OHCH2CH(OH)CH2OH (Propane-1,2,3-triol).
8. **Polyhydric alkanols:** Also known as **Polyols,** have more than three hydroxyl group. Examples; CH3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH3 (Heptane-2,34,5,6- pentanol).

**2).** In Grignard synthesis:

Using Methylmagnesium Chloride (CH3MgCl);

O

|| CH3MgCl

CH3CH2CH2CH2- C- CH2CH2CH3

OMgCl

| H2O/H+

CH3CH2CH2CH2-C-CH2CH2CH2

|

CH3

OH

CH3CH2CH2CH2 C CH2CH2CH3

CH3

**3).** Carbohydrates such as starch are major group of natural compounds that can be made to yield ethanol by the biological process of **Fermentation.** The biological catalysts, enzymes found in yeast breakdown the carbohydrate molecules into ethanol to give a yield of 95%. The starch containing materials including; molasses, potatoes, rice, cereal and on warming with malt to 60oc for a specific period of time are converted into maltose by the enzyme, amylase present in malt.

2(C6H10O5)n + nH2O nC12H22O11

Carbohydrate 60oc maltose

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

C12H22O11 +H2O 2C6H12O6

Maltose 15oc/maltose glucose

The glucose at constant temperature of 15oc is then converted into alcohol (ethanol) by the enzyme zymase contained also in yeast.

C6H12O6 2CH3CH2OH +2CO2

maltose15oc/zymase Ethanol

**4).** Reduction of Alkanone leads to a secondary alcohol and the reduction of Alkanal leads to a primary alcohol. Hence, the specific examples; The reduction of propanone leads to propan-2-ol and the reduction of ethanol leads to ethanol.

O OH

CH3 C + 2H CH3 C H

H H

O H

|| |

CH3  C + 2H CH3  C CH3

| |

CH3  OH