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COLLEGE: MHS DEPT: MBBS LEVEL: 100

COURSE: CHEM 102(CHEMICAL CHEMISTRY II)

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

ANSWER

I. Classification based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group.

a. Primary alcohols (10): When the number of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two. EgCH3CH2OH Ethanol

b. Secondary alcohols (20): If it is one hydrogen atom attached to the carbon atom bearing the hydroxyl group. Eg CH3CH(OH)CH3 Propan-2-ol

c. tertiary alcohols (30): if no hydrogen atom is attached to the carbon atom containing the hydroxyl group, it is called a tertiary alcohol. Eg (CH3)3C-OH 2-methylpropan-2-ol

II. Classification based on the number of hydroxyl groups they possess.

a. Monohydric alcohols: have one hydroxyl group present in the alcohol structure. Eg CH3CH2CH2OH Propanol

b. Dihydric alcohols or Glycols: have two hydroxyl groups present in the alcohol structure. Eg HOCH2CH2OH Ethane-1,2-diol

c. Trihydric alcohols or Triols: have three hydroxyl groups present in the alcohol structure. Eg OHCH2CH(OH)CH2OH Propane-1,2,3-triol

d. Polyhydric alcohols or Polyols: have more than three hydroxyl groups present in the alcohol structure. Eg CH3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH3 Heptane-2,3,4,5,6-pentaol

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

ANSWER

Lower alcohols with up to three carbon atoms in their molecules are soluble in water because these lower alcohols can form hydrogen bond with water molecules. The water solubility of alcohols decreases with increasing relative molecular mass.

All monohydric alcohols are soluble in organic solvents. The solubility of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bonds with water molecules.

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

ANSWER

On warming starch containing materials with malt to 60oC for a specific period of time, the starch is converted into maltose by the enzyme diastase contained in the malt.

2(C6H10O5)n + nH2O nC12H22O11

Carbohydrate 60oC/diastase 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/maltase glucose

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

C6H12O6 2CH3CH2OH + 2CO2

Glucose 15oC/zymase Ethanol

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

ANSWER

CH3CH(CH3)CH=O + C4H9(Mg)Cl CH3CH(CH3)CH(C4H9)-OMgCl

2-methylpropanal

CH3CH(CH3)CH(C4H9)-OMgCl H+ OH- CH3CH(CH3)CH(C4H9)-OH + Mg(OH)Cl

2-methyl heptan-3-ol

QUESTIONS 5 AND 6 ARE INCORRECT

7. Show the reduction reaction of 2-methyl propanal.

ANSWER

CH3CH(CH3)CH=O LiAlH4 CH3CH(CH3)CH2OH

2-methylpropanal primary alcohol(2-methylpropanol)

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

ANSWER

CH3CH2CH2OH + H2SO4 CH3CH(OSO3H)CH3 + H2O

Propan-1-ol

CH3CH(OSO3H)CH3 -H2SO4 CH3CHCH2 + H2O

CH3CHCH2 +H2O CH3CH(OH)CH3

Propan-2-ol