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***19/MHS02/077***

***Nursing science***

***100 Level***

***Medical and health sciences***

***Chem102***

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

*A. Classification based on the number of hydrogen atoms attached to the carbon atom containing the OH functional group.*

*(i) Primary alkanols (10)3 or 2 hydrogen atoms attached.*

*(ii) Secondary alkanols (20) 1 hydrogen atom attached.*

*(iii) Tertiary alkanols (30) no hydrogen atom attached.*

 *Examples.*

 *Methanol CH3OH (1°)*

 *Propan-2-ol CH3CH (OH) CH3 (2°)*

 *B. Classification based on the number of OH functional group present in the structure of the alcohol.*

 *(i)Monohydric alcohol (one OH group present in the alcohol structure).*

 *(ii) Dihydric alcohols or glycols (two OH group present in the structure).*

 *(iii) Trihydric alcohols or triols (three OH groups present in the structure).*

 *(iii) Polyhydric alcohols or polyols (have more than 3 OH groups present in the structure).*

 *Examples*

*Monohydric alcohol – Propanol (CH3CH2CH2OH)*

 *Dihydric alcohol – Ethane-1, 2-diol (HOCH2-CH2OH)*

*(2) 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.. The reason why the solubility decreases as the length of hydrocarbon chain increases is because it is requires more energy to overcome the hydrogen bonds between the alcohol molecules as the molecules are more tightly packed together as the size and mass increases. Generally, non polar solutes are soluble in non polar solvents. Alcohol is soluble in organic solvents.*

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

*Carbohydrate 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 break down the carbohydrate molecules into ethanol to give a yield of 95%. On warming starch with malt to 60° for a specific perio6of time are converted into maltose by the enzyme diastase contained in the malt.*

*2(C6H10O5)n +nH2O. ——> n(C12H22O11)*

*Carbohydrate 60°C / diastase. Maltose*

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

*C12H22O11 + H2O. ——–> 2C6H12O6*

 *Maltose. 15°C / maltase. Glucose*

*The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme Zymase contained also in yeast*

*C6H12O6. ———> 2CH3CH2OH + 2CO2*

*Glucose. 15°C / Zymase Ethanol*

*(4) Show the reaction between 2-methyl propanal and butyl magnesium chloride. (CH3)2CHCH=O + C4H9MgCl ———> C4H9CH(CH3)2CH-OMgCl*

 *+ H2O*

 *Dilute acid*

 *C4H9CH (CH3)2CH-OH + MgClOH*

*(5) (CH3)2CH2C=O + C4H9MgCl ———> C4H9(CH3)2C-OMgCl ———>*

 *H2O dilute acid*

 *C4H9CH2 (CH3)2C-OH + MgClOH*

*(6) Show the reduction reaction of 2-methyl propanal*

*(CH3)2CHCH=O ———> (CH3)2CHCH2OH*

*2methyl propanal*

*(7) Show the reduction reaction of 2-methyl propanone*

 *(CH3)2CH2C=O —-——> (CH3)2CH2CH-OH*

 *2methyl propanone*

*(8) Show the conversion of propan-1-ol to propan-2-ol*

*CH3-CH2-CH2-OH (propan-1-ol)*

 *Heat in the presence of concentrated H2SO4, to dehydrate it and form propene*

 *(CH2=CH-CH3)*

 *CH3-CH2-CH2-OH ——> CH2=CH-CH3 (after heating with concentrated H2SO4)*

*Now to propene add water (you may use mercuric acetate as it favors Markownikoff addition)*

*CH3-CH=CH2 + H2O = CH3-CH (OH)-CH3 (propan-2-ol)*