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COURSE TITLE: GENERAL CHEMISTRY II

**QUESTION**

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

**Answer**

**i) This is based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group.**

**a) Primary alcohol**: has 2 or 3 attached to the carbon carrying the OH

MethanoI

 **H**

 **H-C-OH**

 **H**

**CH3OH**

**b) Secondary Alcohol:** has 1 hydrogen atom attached to the carbon carrying the OH. It has 2 alkyl groups attached to the carbon atom bearing the OH.

e.g PROPAN-2-OL

 **H**

**CH3-C-OH**

 **CH3**

**CH3CH(OH)CH3**

**c) Tertiary:** has no hydrogen atom attached to the carbon atom bearing the hydroxyl group.

e.g 2-METHYL-PROPAN-2-OL

 **OH**

**CH3-C-CH3**

 **CH3**

**(CH3)C-OH-OH**

**ii) With number of hydroxyl or OH group.**

1. **Primary alcohol:** these are alcohols with one hydroxyl group. They are also called monohydric alcohol e.g Propanol (CH3CH2OH).
2. **Secondary alcohol:** these alcohols have 2 OH present in structure. It is called dihydric alcohol or glycol. E.g HOHCH2CH2OH Ethane-1,2-diol(Dihydric alcohol)
3. **Tertiary alcohol:** these alcohols have 3 OH functional groups in the structure. It can be called trihydric or triol. e.g propan 1-2-3 triol.
4. **Polyhydric or polyol alcohols:** these alcohols have more than 3 OH present in the structure.
5. **Discuss the solubility of alcohols in water, organic solvents.**

**Answer**

**Solubility in water**

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.

**Solubility in organic solvent**

Alcohols are derived either from natural product processing such as the fermentation of carbohydrates and the reductive cleavage of natural fats and oils or by chemical synthesis based on the hydrocarbons derived from petroleum or by synthetic gas from coal.

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

**Answer**

**i)**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 break down the carbohydrate molecules into ethanol to give a yield of 95%. 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**

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

**C12H22O11  +H2O 2C6H12O6**

**Maltose 15oC/maltase glucose**

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

**C6H12O6  2CH3CH2OH +2CH3CH2OH +2CO2**

**Glucose 15oC/Zymase Ethanol**

1. **Show the reaction between 2-methyl propanal and butyl magenesium chloride**

**Answer**

 **S+ S- S- S+**

**CH3 CH CHO + CH3CH2CH2CH2MgCl**

 **CH3 butlyl magnesium chloride**

**2 Methyl Propanol**

 **CH3CH2CH2 S-**

 **CH3CH2CH2CH2  C + OMgCl OH- H+**

 **CH2CH2CH3**

 **CH3CH2CH2CH2 C OH + Mg(OH)Cl**

 **Octan -4-nol**

**5)INCORRECT**

**6)INCORRECT**

**7)Show the reduction reaction of 2 -methyl propanal**

**Answer**

 **(H2)**

**CH3 CH – CHO CH3CH CH2OH**

 **CH3 LiNH4/(C2H5)2O CH3**

**2 methyl propanal 2 methyl propanol**

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

**Answer**

**CH3CH2CH2OH +H2SO4 CH3CH2CH2OH2+OSO3H**

**Propan-1-ol -H2O**

 **CH3CH2CH2 OSO3H**

 **-H -H2SO4**

**CH3CH=CH2**

 **Propene**

**Hydrate propene to give propan-2-ol**

 **S+ S- H+ OH-**

 **CH3CH=CH2 CH3CHOHCH3**

**Propan-2-ol**