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COMPUTER ENGINEERING

CHEM 102

1. Give IUPAC names of the following organic compounds
   (i) CH_3OCH_3 : Methoxymethane
   (ii) $CH_3CH_2OCH_2CH_3$: Ethoxyethane
   (iii) $(CH_3CH_2CH_2CH_2)_2O$: Butoxymethane
   (iv) $CH_3CH_2OCH_3$: Methoxyethane
   (v) $CH_3CH_2CH_2OCH_2CH_3$: Ethoxypropane

2. Discuss the properties of ethers
   (i) Physical states: At room temperature, ethers are colorless, neutral liquids with pleasant odors. The lower aliphatic ethers are highly flammable gases or volatile liquids.
   (ii) Solubility: Ethers are less soluble in water than are the corresponding alcohols. Lower molecular weight ethers such as methoxymethane and methoxyethane are fairly soluble in water since the molecule are able to form hydrogen bonds with the water molecules but as the hydrocarbon content of the molecules increases, there is a rapid decline in solubility. They are miscible with most organic solvents.
   (iii) Density: Most of the simple ethers are less dense than water, although the density increases with increasing relative molecular mass and some of the aromatic ethers are in fact denser than water.

(iv) Boiling point: Low molecular mass ethers have a lower boiling point than the corresponding alcohols but those ethers containing alkyl radicals larger than four carbon atoms, the reverse is true. The boiling point of ethers tend to approximate those of hydrocarbons of same relative molecular mass from which it can be concluded that the molecules are not associated in the liquid phase as there are no suitably available hydrogen for association through hydrogen bonds.

(v) Reactivity: Ethers are inert at moderate temperature. Their inertness at moderate temperatures leads to their wide use as reaction media. Simple ethers are not found in nature but the ether linkage is present in natural products such as sugars, starches and cellulose

3. Discuss explicitly two methods of preparing ethers and show the equations of reaction

(i) Partial dehydration of alcohols: Simple ethers are manufactured from alcohols by catalytic dehydration. The alcohol in excess and concentrated tetraoxosulphate(vi)acid is heated at a carefully maintained temperature of 140°C. This process is known as continuous etherification. If excess alcohol is not used, the temperature is as high as 170-180°C, further dehydration to yield alkene occurs.

$$2ROH \xrightarrow[\text{Conc. } H_2SO_4/140^\circ C]{} R\text{-}O\text{-}R + H_2O$$

$$2CH_3CH_2OH \xrightarrow[\text{Conc. } H_2SO_4/140^\circ C]{} CH_3CH_2\text{-}O\text{-}CH_2CH_3 + H_2O$$

(ii) Controlled catalytic hydration of olefins

$2CH_3CH{=}CH_2 + H_2O \rightarrow (CH_3)_2CH{-}O{-}CH(CH_3)_2$

2-isopropoxypropane

4. State three uses of ethylene oxide
   (i) Ethylene oxide is used as an intermediate in the hydrolytic manufacture of ethylene glycol
   (ii) Ethylene oxide is used as a gaseous sterilizing agent
   (iii) Ethylene oxide is used in the preparation of non-ionic emulsifying agents, plastics, plasticizers and several synthetic textiles.