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1. Give the IUPAC names of the following organic compounds: CH_3OCH_3 $CH_3CH_2OCH_2CH_3$ $(CH_3CH_2CH_2CH_2)_2O$ $CH_3CH_2OCH_3$ $CH_3CH_2CH_2OCH_2CH_3$

Answer

a) CH_3OCH_3 — Methoxymethane
b) $CH_3CH_2OCH_2CH_3$ — Ethoxyethane
c) $(CH_3CH_2CH_2CH_2)_2O$ — Butoxybutane
d) $CH_3CH_2OCH_3$ — Methoxyethane
e) $CH_3CH_2CH_2OCH_2CH_3$ — Ethoxypropane

2. Discuss the properties of ethers

Answer

a) Physical state: Ethers are colourless, neutral liquids with pleasant odours at room temperature. The lower aliphatic ethers are highly flammable gases or volatile liquids.
b) Solubility: Ethers are less soluble in water than the corresponding alcohols. Lower weight ethers such as methoxymethane and methoxyethane are fairly soluble in water but as the hydrocarbon content of the molecules increases, there is a rapid decline in solubility. Ethers are also miscible with most organic solvents.
c) 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.
d) Boiling point: Low molecular mass ethers have a lower boiling point than the corresponding alcohols but for ethers containing alkyl radicals larger than four carbon ethers, the reverse is true.
e) Reactivity: Ethers are inert at moderate temperature. And this leads to their wide use as reaction media.

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

Answer

a) From Haloalkanes and dry Silver (I) oxide

$$2RX + Ag_2O \xrightarrow{\text{warm}} R\text{-}O\text{-}R + 2AgX$$

$$2CH_3CH_2CH_2Cl + Ag_2O \xrightarrow{\text{warm}} CH_3CH_2CH_2OCH_2CH_2CH_3 + 2AgCl$$

Propoxypropane

b) 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. The process is known as continuous etherification. If excess alcohol is not used, the temperature is too high as 170 - 180°C, further dehydration to yield alkene occurs.

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

$$2CH_3CH_2OH \xleftarrow{\text{conc. } H_2SO_4 / 140^\circ C} CH_3CH_2OCH_2CH_3 + H_2O$$

Ethoxyethane

4. State three uses of ethylene oxide.

Answer

a) Ethylene oxide is used as an intermediate in the hydrolytic manufacture of ethylene glycol.

b) Ethylene oxide is used in the preparation of nonionic emulsifying agents, plastics, plasticizers and Second synthetic textiles.

c) Ethylene oxide is used as a gaseous sterilizing agent.