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19/ENG02/026

COMPUTER ENGINEERING

CHEM 102

1) Give the IUPAC names of the following organic compounds

a CH_3OCH_3 : Methoxymethane

b $CH_3CH_2OCH_2CH_3$: Ethoxyethane

c $(CH_3CH_2CH_2CH_2)_2O$: Pentanamide

d $CH_3CH_2OCH_3$: Methoxyethane

e $CH_3CH_2CH_2OCH_2CH_3$: Ethoxypropane

2 Discuss the properties of ethers

A Physical Properties

i An ether molecule has a net dipole moment due to the polarity of C-O bonds

ii The boiling point of ethers is comparable to the alkanes but much lower than that of alcohols of comparable molecular mass despite the polarity of the C-O bond.

iii Ether molecule are miscible in water. This is attributed to the fact that like alcohol, the oxygen atom of ether can also form hydrogen bonds with a water molecule.

iv 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.

v Reactivity: Ethers are inert at moderate temperature. Their inertness at moderate temperatures leds to their wide us as a reactio media.

B Chemical Properties

i Doesn't react with bases, active metals, oxidizing agents and reducing agents

ii Strong acids will cleave esters at elevated temperatures

iii When stored in presence of oxygen, esters will form explosive peroxides such as diethyl ether peroxide iv Electrophilic Substitution; The alkyl group in ethers activates the aromatic ring at ortho and para positions for electrophilic substitutions - Common electrophilic substitution reactions are halogenation, Freidel Craft's reaction etc

3 Discuss explicity two methods of preparing ethers and show equations of reaction

i Making esters from acid anhydrides

This reaction can again be used to make esters from both alcohols and phenols. The reactions are slower than the corresponding reactions with acyl chlorides, and you usually need to warm the mixture. In the case of a phenol, you can react the phenol with sodium hydroxide solution first, producing the more reactive phenoxide ion.

Taking ethanol reacting with ethanoic anhydride as a typical reaction involving an alcohol. There is a slow reaction at room temperature (or faster on warming). There is no visible change in the colorless liquids, but a mixture of ethyl ethanoate and ethanoic acid is formed.

$$(CH_3CO)_2O + CH_3CH_2OH \longrightarrow CH_3COOCH_2CH_3 + CH_3COOH_2$$

The reaction with phenol is similar, but will be slower. Phenyl ethanoate is formed together with ethanoic acid.

If the phenol is first converted into sodium phenoxide by adding sodium hydroxide solution, the reaction is faster. Phenyl ethanoate is again formed, but this time the other product is sodium ethanoate rather than ethanoic acid.

ii Controlled Catalytic hydration of olefins

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

4 State three uses of ethylene Oxide

i A small but important use of ethylene oxide is the sterilization of medical equipment, including the sterilization of personal protective equipment used by doctors and hospiticals across the country

ii Most ethylene oxide is used as an intermediate in the production of other chemicals used to manufacture products, such as fabrics for clothes, upholstery, carpet and pillows.

iii Ethylene glycol, which is derived from ethylene oxide, is used to manufacture fibreglass used in productss ranging from jet skis to bath tubs to bowling balls, as well as polyethylene terephthalate (PET) plastic resin to make beverage containers and packaging film