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DEPARTMENT: COMPUTER ENGINEERING
COURSE: CHM 102

1.) Give the IUPAC names of the following Compounds

a) $HCOOH$ ⟶ Methanoic Acid

b.) $HOOCH_2CH_2CH_2COOH$ ⟶ Pentan-1, 5-dioc acid

c.) $CH_3CH_2CH_2COOH$ ⟶ Butanoic acid

d.) HO_2C-CO_2H ⟶ Ethanedioic acid

e.) $CH_3(CH_2)_4COOH$ ⟶ Hexanoic acid

f.) $CH_3CH=CHCH_2CH_2COOH$ ⟶ Hex-4-encoic Acid.

② ~~Discuss briefly the~~ Physical ~~Appearance~~ Properties of Carboxylic Acid

a) Physical Appearance: All simple aliphatic Carboxylic acids up to C_{10} are liquids of room temperature. Most other Carboxylic acids are Solid at room temperature although anhydrous Carboxylic acid (Acetic Acid) also known as glacial ethanoic acid freezes to an ice-like Solid below the room temperature.

b.) Boiling Point: It increases with increasing relative molecular Mass. Aromatic Carboxylic acids are Crystal Solids and have higher Melting points than their aliphatic Counterparts of Comparable relative Molecular Mass

c) Solubility: Lower molecular mass Carboxylic acids with up to four Carbon atom in their molecules are Soluble in Water: this Largely due to their ability to form hydrogen bonds with water molecules. The Water Solubility of the acids decreases as the relative molecular mass increases because the Structure becomes relatively more hydrocarbon in nature and hence Covalent. All Carboxylic acids are Soluble in organic Solvents.

③ INDUSTRIAL PREPARATIONS OF CARBOXYLIC ACIDS

a) From Petroleum: Liquid phase air oxidation of C_5-C_7 alkanes, Obtainable from petroleum at high temperature and pressure will give C_5-C_7 Carboxylic acids with Methanoic, propanoic and butanedioic acids as by-products.

$$C_5-C_7 \xrightarrow{O_2/\text{High temp and Pressure}} C_5-C_7 \text{ Carboxylic Acid}$$

b) From Ethanol: Ethanoic acid is Obtained Commercially by the liquid phase air-oxidation of 5% Solution of ethanol to ethanoic acid using Manganite (ii) ethanoate Catalyst. Ethanol itself is obtained from ethylene

$HC \equiv CH \xrightarrow{dil.\ H_2SO_4/HgSO_4} CH_3CHO \xrightarrow{O_2/(CH_3COO)_2Mn}$
CH_2COOH

(+) With equations and brief explanation, discuss the Synthetic preparation of Carboxylic acid
Hydrolysis of nitrites (cyanides) or esters

$RCN + 2H_2O \xrightarrow{H^+} RCOOH + NH_4^-$

$RCOOR \xrightarrow{H_2O/H^+\ reflux} RCOOH + ROH$

$C_6H_5CH_2CN + 2H_2O \xrightarrow{H^+} C_6H_5CH_2COOH + NH_4^+$

$CH_3CH_2COOCH_3 \xrightarrow{H_2O/H^+\ reflux} CH_3CH_2COOH + CH_3OH$

R = alkyl or aryl radical

REDUCTION, DECARBOXYLATION AND ESTERIFICATION OF CARBOXYLIC ACID.

a) Reduction

$4RCOOH + 3LiAlH_4 \xrightarrow{(C_2H_5)_2O} (RCH_2O)_4ALLi + 2LiAlO_2H_4$

$\downarrow$

$4RCH_2OH + Al(OH)_3 + LiOH$

$CH_2CH_2CH_2COOH \xrightarrow{LiAlH_4} CH_2CH_2CH_2CH_2OH$

Butanoic Acid → Butanol