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**Department:** Nursing

**Matric number:** 19/MHS02/038

**Course code:** CHM 102

**1 . IUPAC names of :**

a . **HCOOH**- Methanoic acid

b . **HOOCCH2CH2CH2COOH**- Pentan-1,5-dioic acid

c . **CH3CH2CH2COOH**- Ethanedioic acid

d . **CH3(CH2)4COOH**- Hexanoic acid

e . **CH3CH2=CHCH2CH2COOH**- Hex-4-eneoic acid.

**2 . Physical properties of carboxylic acids under :**

i . **Physical appearance :**

All simple aliphatic carboxylic acids up to C10 are liquids at 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.

ii . **Boiling points :**

Boiling point increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable molecular mass.

iii . **Solubility :**

Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water, this largely due to their ability to form hydrogen bonds with water molecules. The watrt 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 preparation of carboxylic acids:**

i . **From Carbon(II) oxide :**

Methanoic acid (formic acid) is manufactured by adding carbon(II)oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate(vi) acid (H2SO4)

CO——>HCOONa ———>HCOOH + NaHSO4

NaOH. H2SO4.

ii . **From petroleum:**

Liquid phase air oxidation of C5-C7 alkanes, obtainable from petroleum at high temperature and pressure will give C5-C7 carboxylic acids with methanoic, propanoic and butenedioic acids as by-products.

C5-C7 —————————————>C5-C7

carboxylic acid

O2/ High temperature and pressure

**4 . Synthetic** **preparation** **of carboxylic** **acids**.

i . **Oxidation of primary alcohols and aldehydes :**

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents(i.e K2Cr2O7 or KMnO4) in acidic solution.

RCH2OH —————————> RCHO ———> RCOOH [O],excess acid/KMnO4. [O]

ii . **Carbonation of Grignard reagent :**

Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into the Grignard reagent and then hydrolyzed with dilute acid.

RMgBr+CO2———>RCOOMgBr———>RCOOH+MgBrOH (C2H5)2O. H2O/dilute acid

R may be 1°, 2°, 3° aliphatic or aryl radical.

iii . **Hydrolysis of nitriles(cyanides) or esters**

RCN + 2H2O ————>RCOOH + NH4+

**5 . Reduction, decarboxylation and esterification of carboxylic acid.**

**a . Reduction to primary alcohol :**

CH3CH2CH2COOH—————>CH3CH2CH2CH2OH. LiAlH4

Butanoic acid. Butanol

**b . Decarboxylation**

Thermal decarboxylation

2CH3CH2COONa+2H2O————–> CH3(CH2)2CH3+CO2(anode)+2NaOH+H2(cathode) ( electrolysis/aq. CH3OH)

**c . Esterification**

CH3CH2CH2COOH+CH3CH2CH2OH——> CH3CH2CH2COOCH2CH2CH3+H2O. [H+]