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1) GIVE THE IUPAC NAME OF THE FOLLOWING

HCOOH = METHANOIC ACID HOOCCH2 CH2 CH2 COOH = PENTAN-1,5-DIOIC ACID CH3 CH2 CH2 COOH = BUTANOIC ACID HO2 C-CO2H = ETHANEDIOIC ACID CH3 (CH2)4 COOH = HEXANOIC ACID CH3 CH=CH CH2 CH2 COOH – HEX- 4 ENE OIC ACID

2) DISCUSS BRIEFLY THE PHYSICAL PROPERTIES OF CARBOXYLIC ACIDS UNDER THE FOLLOWING HEADING

Physical appearance: All simple aliphatic carboxylic acids up to C10 are liquids at room temperature. While most other carboxylic acids are solid at room temperature. Anhydrous carboxylic acids (acetic acids) are known as glacial ethanoic acid freezes to an ice like solid below the room temperature.

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 relative molecular mass.

Solubility: Lower molecular mass carboxylic acid with up to four carbon atoms in their molecules are soluble in water, this is due to their ability to form hydrogen bond with water molecules. All carboxylic acids are soluble in organic solvents.

3) WRITE THE INDUSTRIAL PREPARATION OF CARBOXYLIC ACIDS

I. From ethanol: Ethanoic acid is obtained commercially by the liquid phase airoxidation of 5% solution of ethanol to ethanoic acid using manganite (II) ethanoate catalyst. Ethanal itself is obtained from ethylene

HC= CH_dil_H2SO4/HgSO4 CH3 CHO O2/(CH3COO)2 mn _ CH3COOH

II. 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 NaOH HCOONA H2SO4 HCOOH +NaHSO4

4) SYNTHETIC PREPARATION OF CARBOXYLIC ACID

i. **Oxidation of primary alcohol and aldehydes** : These can be use to prepare carboxylic acids using the usual oxidizing agent (i.e K2Cr2O7 or KMNO4)in acidic solution.

RCH2OH [O]. excess acid/ KMNO4 →RCHO [O] → RCOOH

ii. Hydrolysis of nitriles (cyanides) or esters RCN + 2H₂O $\xrightarrow{H^+}$ RCOOH + NH4⁺ RCOOR' H<u>2O/H⁺ REELUX</u> RCOOH + R'OH C6 H5 CH2 CN +2H₂O $\xrightarrow{H^+}$ C6H5CH2COOH + NH4⁺ CH3 CH2 COOCH3 $\xrightarrow{-H_2O/H^+}$ REELUX > CH3 CH₂ COOH + CH₃OH

iii) Carbonation of Grignard reagent: Aliphatic carboxylic acids are obtained by bubbling carbon (Iv) oxide into the Grignard reagent and then hydrolyzed with dilute acid.

 $\begin{array}{cccc} RMgBr + CO2 & (C2H5)2O & RCOOMgBr & H2O/dIL.acid & RCOOH+ MgBrOH \\ \hline R & may be 1_0 2_3 3_3 & aliphatic alkyl or aryl radical \end{array}$

5)

Reduction to primary alcohol

4RCOOH +3LiAIH4 (C2H5)20 (RCH2O) 4AILi + 2LiAIO2 + 4H2

4H2O

4RCH2OH + AI (OH)3 +LiOH

CH3 CH2 CH2 COOH LIAIH4 > CH3 CH2 CH2 CH2 OH

Butanoic acid

butanol

✤ Decarboxylation

CH3 CH2 CH2 COONa +NaoH – FUSE > CH3 CH2 CH3 + Na2CO3

Kolbe synthesis

2CH3 CH2 COONa + 2H2O _____electrolysis/aq. CH3 OH CH3 (CH2)2 CH3 + CO2 (ANODE) + 2NaOH +

H2 (cathode)

✤ Esterification

CH3 CH2 CH2 COOH + CH3 CH2 CH2 CH2 OH H^+ CH3 CH2 CH2 CH2 CH2 CH3 +H2O