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CHEM102 COVID19 ASSIGNMENT ON CARBOXYLIC ACID

1. Give the IUPAC names of the following compounds
 - i. HCOOH: Methanoic acid
 - ii. HOOCCH₂CH₂CH₂COOH: Pentan-1,5-dioic acid
 - iii. CH₃CH₂CH₂COOH: Butanoic acid
 - iv. HO₂CCO₂H: Ethanedioic acid
 - v. CH₃(CH₂)₄COOH: Hexanoic acid
 - vi. CH₃CH=CHCH₂CH₂COOH: Hex-4-eneoic acid
2. Discuss briefly the physical properties of carboxylic acid under the following headings
 - i. Physical appearance: All simple aliphatic carboxylic acids up to C₁₀ are liquids at room temperature. Most other carboxylic acid 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 points increases with increasing molecular mass. Aromatic carboxylic acid are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.
 - iii. Solubility: Lower molecular mass carboxylic acids with up to carbon atoms in their molecules are soluble in water; this is largely due to their ability to form hydrogen bond with water molecules. The water solubility of 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. Write two industrial preparations of carboxylic acids
 - i. From carbon(II)oxide
 - ii. From ethanol

Preparation from carbon(II)oxide:

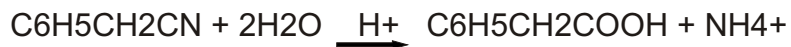
Methanoic acid is made by the addition of carbon(II)oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate(vi) and (H₂SO₄).

Preparation from ethanol:

Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanoic acid using manganite(II)ethanoate catalyst. Ethanol itself is obtained from ethylene.

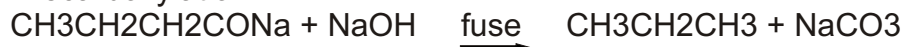
4. With equation and brief explanation discuss the synthetic preparation of carboxylic acid
 - i. Oxidation of primary alcohols and aldehydes:
Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents in acidic solution.
$$\text{RCH}_2\text{OH} \xrightarrow{\text{[O] excess acid/KMnO}_4} \text{RCHO} \xrightarrow{\text{[O]}} \text{RCOOH}$$
 - 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.
$$\text{RMgBr} + \text{CO}_2 \xrightarrow{(\text{C}_2\text{H}_5)_2\text{O}} \text{RCOOMgBr} \xrightarrow{\text{H}_2\text{O/dil. acid}} \text{RCOOH} + \text{MgBrOH}$$
 - iii. Hydrolysis of nitriles (cyanides) or esters:
$$\text{RCN} + 2\text{H}_2\text{O} \xrightarrow{\text{H}^+} \text{RCOOH} + \text{NH}_4^+$$

(R= alkyl or aryl radical)



5. With chemical equation only, outline the reduction, decarboxylation and esterification of carboxylic acid

i. Decarboxylation:



Kolbe synthesis



ii. Esterification:

