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CHM 102

ASSIGNMENT

1. HCOOH - Methanoic acid
 $\text{HOOCCH}_2\text{CH}_2\text{COOH}$ - Butane-1,4-dioic acid
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid
 $\text{HOOC}-\text{COOH}$ - Ethanedioic acid
 $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ - Hexanoic acid
 $\text{CH}_2=\text{CH}-\text{CH}_2\text{CH}_2\text{COOH}$ - Hex-4-enoic acid

2. Physical Properties

All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature. Most other carboxylic acids are solid at room temperature although anhydrous carboxylic acid (acetic acid) also known as glacial acetic acid freezes to an ice-like solid below the room temperature.

iii. Boiling Points

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

ii. 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 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 Preparation

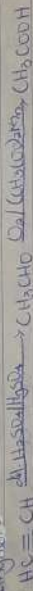
1. From Carbon(II) oxide

Methanoic acid (formic acid) is manufactured by oxidizing 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 (H_2SO_4)



2. From Ethanol

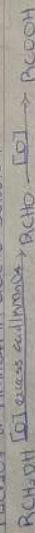
Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganese(II) ethanoate catalyst. Ethanol itself is obtained from ethyne:



4. Synthetic Preparation of Carboxylic Acids

a. Oxidation of primary alcohols and aldehydes:

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidising agents CrO_3 , $K_2Cr_2O_7$ or $KMnO_4$ in acidic solution.



b. Substitution of Grignard reagent

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



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

c. Hydrolysis of nitriles (cyanides) or esters



R (ethyl or aryl radical)

