21/04/20 ASSIGNMENT ON CARBOXYLIC ACID

Name: Ehichioya Karen Edogbon

Dept Medicine and Surgery

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Answer

1a. $HCOOH$ - Methanoic acid

b. $HOOCCH_2CH_2CH_2COOH$ - Pentane 1,5 dioic 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-eneoic acid

2a. Physical appearance: All simple aliphatic carboxylic acid upto 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 ethanoic acid freezes to an ice-like solid below the room temperature.

b. Boiling Points: B.P. increases with increasing relative molecular mass. Aromatic carboxylic acid are crystalline 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 atoms in their molecules are soluble i

water; this largely due to their ability to form hydrogen bonds with their 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 ~~solvent~~ covalent. All carboxylic acids are soluble in organic solvents.

3a. From Carbon(II) oxide: Methanoic acid (formic acid) is manufactured by adding carbon(II) oxide unde pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphat(VI) acid (H_2SO_4)

$$CO \xrightarrow{NaOH} HCOONa \xrightarrow{H_2SO_4} HCOOH + NaHSO_4$$

b. From Ethanol: Ethanoic acid is obtained commercially by the liquid phase air-oxiditation of 5% solution of ethanal to ethanoic acid using ~~mang~~ manganite(II) ethanoate catalyst. Ethanal itself is obtained from ethylene.

$$HC \equiv CH \xrightarrow{dil.\ H_2SO_4/HgSO_4} CH_3CHO \xrightarrow{O_2/(CH_3COO)_2Mn} CH_3COOH$$

4a. 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. $K_2Cr_2O_7$ or $KMnO_4$) in acidic solution.

$$RCH_2OH \xrightarrow{[O],\ excess\ acid/KMnO_4} RCHO \xrightarrow{[O]} RCOOH$$

m hydrogen
lubility of the
s increases
hydrocarbon is
are soluble in

ic acid) is
nde pressure to
e free
with tetraoxo-

aHSO4

ally by the
anal to
e catalyst.

→ CH3COOH

Oxidation
to prepare
gents (i.e.

RCOOH

5a. Esterification:

$CH_3CH_2CH_2COOH + CH_3CH_2CH_2OH \xleftarrow{H^+} CH_3CH_2CH_2$

$CH_3CH_2CH_2COOCH_2CH_2CH_3 + H_2O$

b. Decarboxylation:

$CH_3CH_2CH_2COONa + NaOH \xrightarrow{fuse} CH_3CH_2CH_3 + Na_2CO_3$

Kolbe synthesis:

$2CH_3CH_2COONa + 2H_2O \xrightarrow{electrolysis/aq\ CH_3OH} CH_3(CH_2)_2CH_3 +$

CO_2 (anode) $+ 2NaOH + H_2$

c. Oxidation: