

ADESOYE ADEDOLAPO ADEDOYIN

19/MHS11/014

PHARMACY

CHEM 102

1. Give the IUPAC names of the following compounds

- i. HCOOH Methanoic acid
- ii. $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$ Pentan-1,5-dioic acid
- iii. $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ Butanoic acid
- iv. $\text{HO}_2\text{C}-\text{CO}_2\text{H}$ Ethanedioic acid
- v. $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ Hexanoic acid
- vi. $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ Hex-4-eneoic acid

2. Physical properties of carboxylic acids

- i. Physical appearance

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 ethanoic acid freezes to an ice-like solid below the room temperature.

ii. Boiling point

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.

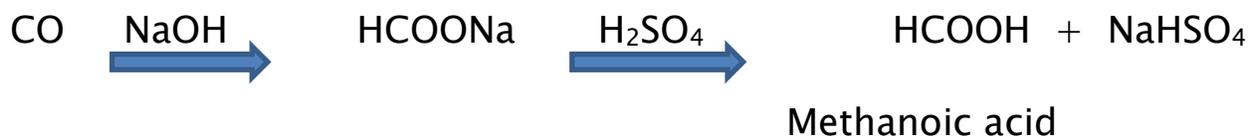
iii. Solubility

Lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water; this is 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 preparations of carboxylic acids

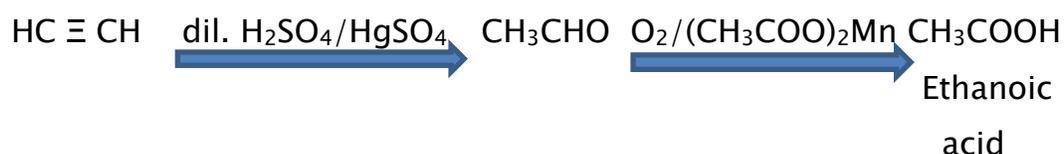
i. From carbon (II) oxide

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 (H_2SO_4)



ii. From ethanol

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



4. Synthetic preparation of carboxylic acid

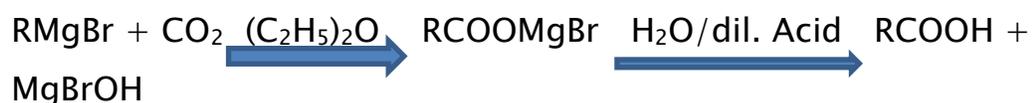
i. Oxidation of primary alcohols and aldehydes

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agent (i.e $\text{K}_2\text{Cr}_2\text{O}_7$ or KMnO_4) in acidic solution



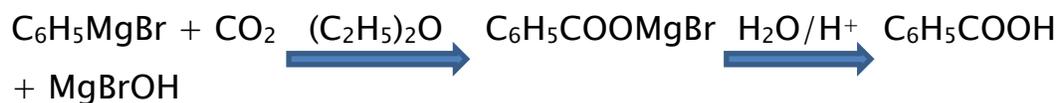
ii. Carbonation of Grignard reagent

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



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

In the preparation of benzoic acid, the reagent is added to solid carbon (IV) oxide (dry ice) which also serves as coolant to reaction mixture



iii. Hydrolysis of nitriles (cyanides) or esters



(R=alkyl or aryl radical)



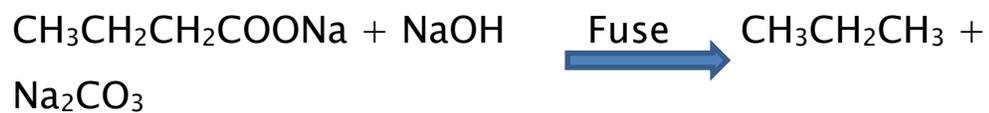
5. Equations of the reduction, decarboxylation and esterification of carboxylic acid

i. Reduction of carboxylic acid to primary alcohol

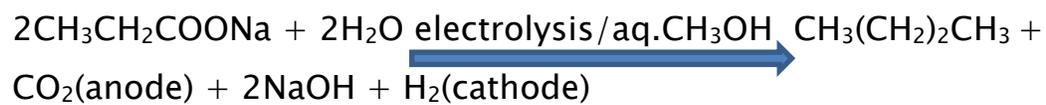


ii. Decarboxylation

– Thermal decarboxylation



– Kolbe synthesis



iii. Esterification

