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CHM 102 ASSIGNMENT ON CARBOXYLIC ACIDS

1. IUPAC NAMES OF GIVEN ORGANIC COMPOUNDS

HCOOH- Methanoic acid

HOOCCH₂CH₂CH₂COOH- Pentan-1, 5-dioic acid

CH₃CH₂CH₂COOH- Butanoic acid

HO₂C-CO₂H- Ethanedioic acid

CH₃(CH₂)₄COOH- Hexanoic acid

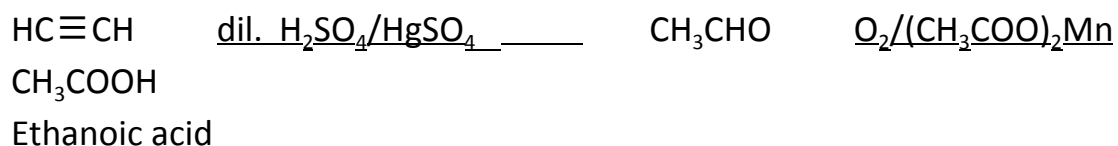
CH₃CH=CHCH₂CH₂COOH- Hex-4-enoic acid

2. PHYSICAL PROPERTIES OF CARBOXYLIC ACIDS

- i. **Physical appearance:** All simple aliphatic carboxylic acids up to C₁₀ 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 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.
- iii. **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 PREPARATIONS OF CARBOXYLIC ACIDS

- i. **From ethanol**



ii. **From petroleum**

Equation:



4. **SYNTHETIC PREPARATIONS OF CARBOXYLIC ACIDS**

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 (i.e. $\text{K}_2\text{Cr}_2\text{O}_7$ OR KMnO_4) in acidic solution.



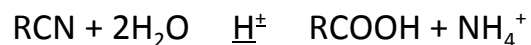
II. **Carbonation of Grignard reagent**

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.

III. **Hydrolysis of nitriles (cyanides) or esters**

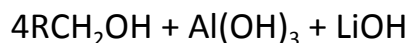
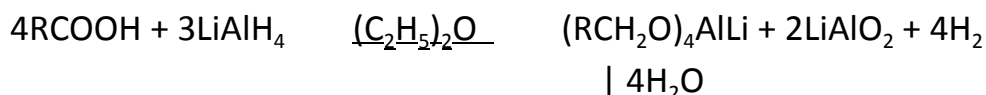


(R=alkyl or aryl radical)



5. **CHEMICAL REACTIONS OF CARBOXYLIC ACIDS**

I. **Reduction to primary alcohol**



Butanoic acid

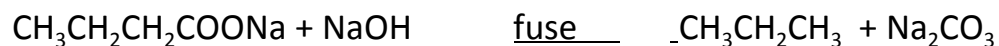
butanol

II. **Decarboxylation**

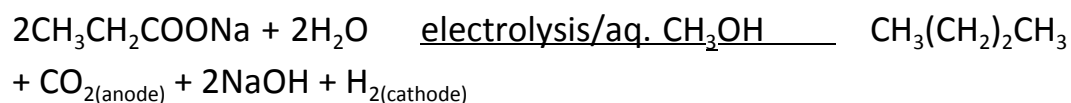
This involves removal of the carboxyl group from the acid to give a hydrocarbon or its derivative

Thermal decarboxylation

Carboxylic acids with a strong electron attracting group e.g $-\text{COOH}$, $-\text{CN}$, NO_2 , $\text{C}=\text{O}$ decarboxylate readily on heating to $100\text{--}150^\circ\text{C}$ while others decarboxylate when their salts are heated with soda lime



Kolbe synthesis



III. Esterification

In the presence of strong acid catalyst, carboxylic acids react with alcohols to form esters

