

Carboxylic Acids

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Assignment

1. Give the IUPAC names of the following compounds

- HCOOH
- $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- $\text{HO}_2\text{C}-\text{CO}_2\text{H}$
- $\text{CH}_3(\text{CH}_2)_4\text{COOH}$
- $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$

- $\text{HCOOH} \rightarrow$ Methanoic acid
- $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$ Pentan-1,5-dioic acid
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rightarrow$ Butanoic acid
- $\text{HO}_2\text{C}-\text{CO}_2\text{H} \rightarrow$ Ethanedioic acid
- $\text{CH}_3(\text{CH}_2)_4\text{COOH} \rightarrow$ Hexanoic acid
- $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH} \rightarrow$ Hex-4-enoic acid

2. Discuss briefly the physical properties of carboxylic acids under the following headings

- Physical appearance
- Boiling point
- Solubility

I PHYSICAL APPEARANCE

All carboxylic acids are colourless, odourless liquids.

II 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 carboxylic acid (acetic acid) also known as glacial acetic acid, it is a ice-like solid below the room temperature.

III BOILING POINTS

The 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.

IV 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 relative solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence insoluble. All carboxylic acids are soluble in organic solvents.

2. Selective Nitro substitution. $R-OH + HNO_3 \rightarrow R-O-NO_2$ or $R-NO_2$ depending on conditions.

3. From $C_{10}H_{12}O_2$ to $C_{10}H_{14}O_2$

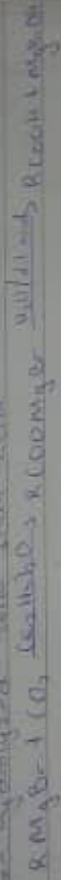
4. With conditions \rightarrow selective substitution of carboxylic acid.

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



6. Oxidation of bicyclic reagents.

Aliphatic carboxylic acids are characterized by burning carbon (hydrocarbons) into the highest oxygenated and then hydrolyzed to form white acid.



R may be $1^\circ, 2^\circ, 3^\circ$ aliphatic alkyl or aryl radical.

7. Hydrolysis of nitriles (cyanides) or esters.

They are organic molecules containing a cyano group which tends to be converted to a carboxylic acid.



5. With chemical equations, explain the oxidation, decarboxylation and reduction of acetoacetic acid

a. DEHYDRATION



Example



Butanoic acid

Butanol

b. DECARBOXYLATION



c. FETTERIFICATION

